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ABSTRACT

The purpose of this study was to review and synthesize a diversity of research and classroom activities concerned with experiential elementary education. To make these materials readily available to teachers, a collection of examples of experiential activities, research, and professional writings was organized into four academic subject areas (language arts, math, science, and social studies) and listed alphabetically by author. Materials within each subject area were further categorized by general learning skills, using Knowles' (1975) taxonomy of roles and their required competencies. As a result of this study, the author developed a series of activities utilizing the philosophy of experiential education, implementing these activities with 40 fourth-grade students in multicultural classrooms. A detailed description of the procedure, activities, and outcomes of the author's experiment are presented, along with recommendations for using experiential activities in the classroom environment. (MP)

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LITERATURE ANALYSIS FOR RELATING CHILDREN'S EXPERIENCES TO SCHOOL

BY

SHEREEN H. WATERMAN, B.A., M.A.

A Thesis Submitted to the Graduate School
in Partial Fulfillment of the Requirements
for the Degree
Specialist in Education

Major Area: Curriculum and Instruction

New Mexico State University
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May, 1982

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ABSTRACT

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The debates over and development of various approaches to education, philosophical and practical, continue. The experiential process has been a major force in education for many years. The purpose of this study was to review, synthesize and bring together research and classroom activities concerned with experiential elementary education. Research in both traditional and experiential education tended to show no statistically significant differences. There appeared to be an increase in multi-ethnic recognition, both in research and in classroom application.

While experiential education has a long history, John Dewey brought it into a major focus in this century. The studies of Jean Piaget increased and demonstrated a potential for scientific testing of developmental cycles and the role of

experience in the learning process. Since then, a quantity of writings about advantages and disadvantages of experiential education has accumulated. Therefore, a search of the literature of the past five years was undertaken, within specified limitations, to present an orderly consideration of examples of classroom experiential activities.

Activities were organized by five academic subjects and alphabetized by authors. To categorize material within each subject by general skills, Knowles' taxonomy of roles and their required competencies was used.

Activities drawn from the recent literature comprise the classroom activities unit of this paper. The writer also developed and taught a fourth-grade science unit utilizing the philosophy of experiential education.

Conclusions from the research and recommendations for using experiential activities in the classroom have been included.

I hear and I forget

I see and I remember

I do and I understand

Chinese proverb

TABLE OF CONTENTS

LIST OF FIGURES viii

CHAPTER

1. INTRODUCTION 1

Limitations of the Study 3

Definitions 3

Assumptions 5

2. BACKGROUND LITERATURE 6

3. METHODOLOGY 14

4. CLASSROOM ACTIVITIES 19

Section 1: Activities From the Literature 19

Section 2: Pilot Unit for an Experiential Classroom 157

5. CONCLUSIONS AND RECOMMENDATIONS 164

Summary 164

Conclusions 165

Recommendations for Classroom Use . . 166

Suggestions for Further Research . . 167

BIBLIOGRAPHY 169

APPENDIX: Student Scores 178

LIST OF FIGURES

Figure

1. Author Matrix 16

2. Statistical Description of Fourth Grade Students 18

3. Comparison of Accuracy of Student Statements 162

4. Pilot Study Student Scores 163

Chapter 1

INTRODUCTION

The purpose of this study is to review, update, synthesize, report and research writings about experiential elementary education to make material available within one source. Published material covered was from the past five years, 1977 to March 1982. One of the main purposes of research is to improve the quality of education through making information available to prcfessionals in the field (Piaget, 1969). There are many skills seen as necessary for students, and many influencing factors for grouping experiential literature that produce controversy.

> Hands-on skeptics may be unimpressed by the findings that students do not go out of control when given the opportunity to structure their own activities in the nondirective atmosphere in an activity-centered science classroom. Reservations still remain as to what kind of learning is taking place. What do students <u>really</u> learn in a classroom where they and the hands-on activities structure and prescribe the learning experiences instead of the teacher? This question has caused more confusion than any other single issue related to the effectiveness of the activity-centered programs. One reason for this confusion is that teachers and researchers seldom agree on the 'yardsticks' used in measuring effectiveness. Too often, tests used in studies of various programs and strategies are biased toward one group or another. Comparing student performances in two different programs using a test constructed with material from only one program tends to produce questionable results. Hence, it is critical that unbiased testing procedures be used in conducting comparative studies. (Skymansky, 1978, pp. 38-39)

The problem to be considered here is that sources of activities are widely scattered through a multitude of forms of professional literature including periodicals and are not readily available to teachers. To make this diversity of material available in one place, a collection of examples of experiential activities, research and professional writings were organized into categories, using a matrix to provide a systematic means for consideration of the material and experiential activities. Each category represented an area of academic curriculum. Those areas which showed less research have been noted. Examples of classroom experiential learning have been presented and discussed, with further suggestions for application.

In reviewing the literature of experiential education, a quantitative increase in material was found from 1972 to 1981, with peaks in 1975, 1978 and 1979. Different subjects appeared to have received emphasis in different years. The cyclic nature of educational perception was noted. The focus of publication in 1975 was mathematics and career education. In 1978 and 1979 the focus was science and social studies (Berger, 1977). Activities for science with friendship and cultural aspects and skills were not as numerous as other categories. Language arts experiences beyond classroom games presented the greatest challenge in the activity search.

Limitations

To be included in this study, literature was required to meet the following specifications:

1. that it was confined to the United States,
2. that it was written in English,
3. that some literature was specifically related to cross-cultural, ethnic aspects,
4. that it pertained to regular elementary classroom students (age 6-12, grades 1-6),
5. that it was limited to the academic fields of language arts, math, reading, science and social studies (which included some outdoor survival skills).

Definitions

1. Concept Formation: A concept is not just one word but the building of an understanding that emerges from real experiences, memories, images, and the product of imaginative thinking. Webster says: 'an idea, especially a generalized idea of a class of objects; a thought, a general notion'.

   Development of concepts: To clarify ideas, names must be attached to objects, differences and likenesses noted, characteristics generalized and ideas verbalized. Meanings should be explained, then reinforced by repeated exposure and discussion. A preferred method would be to place the real object on a table in front of a picture of the item, thus enabling the children to look, feel, compare with the picture. (Carmichael, 1972, p. 98)

2. Curriculum: For the purposes of this study, curriculum is defined as a course of study with intended learning outcomes and methods to achieve these, covering the academic subjects of language arts, math, science and social studies.

3. Experiential Education: For the purposes of this study, experiential education is defined as real life, lab, or simulation, student participatory activities.

4. Experience: Experience is conscious awareness. Perceiving, remembering, imagining, thinking and feeling, insofar as they involve awareness, are processes of experiencing. (Leff, 1978, p. 4)

5. Inquiry: a) The existence of inquiries is not a matter of doubt. They enter into every area of life and into every aspect of every area. In everyday living men examine; they turn things over intellectually; they infer and judge as 'naturally' as they reap and sow, produce and exchange commodities. As a mode of conduct, inquiry is as accessible to objective study as are these other modes of behavior. b) To see that a situation requires inquiry is the initial step in inquiry. c) Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole. (Winn, 1959, p. 62)

6. Life: Life goes on in an environment; not merely in it but because of it, through interaction with it. No creature lives merely under the skin; its subcutaneous organs are means of connection with what lies beyond its bodily frame, and to which, in order to live, it must adjust itself, by accommodation and defense but also by conquest. . . . The career and destiny of a living being are bound up with its interchanges with its environment, not externally but in the most intimate way. . . No form of life does or can stand still; it either goes forward or it goes backward, and the end of the backward road is death. (Winn, 1959, p. 78)

7. Logic: a) Logic is both a science and an art; a science so far as it gives an organized and tested descriptive account of the way in which thought actually goes on; an art, so far as on the basis of this description it projects methods by which future thinking shall take advantage of the operations that lead to success and avoid those which result in failure. b) Man is not logical and his intellectual history is a record of mental reserves and compromises. He hangs on to what he can in his old beliefs even when he is compelled to surrender their logical basis. (Winn, 1959, p. 78)

8. Perception: a) The visible is set in the invisible; and in the end what is unseen decides what happens in the seen; the tangible rests precariously upon the untouched

and the ungrasped. b) We speak of perception and its object. But perception and its objectives are built up and complete in one and the same continuing operation. (Winn, 1959, p. 97)

Assumptions

1. Children develop through a series of stages. (Houston, 1976)
2. Learning is continuous, unconscious and conscious.
3. Experience is always necessary for intellectual development. (Piaget, 1954)
4. The role of experience in curriculum development continues as designers attempt to create and clarify taxonomies, terminologies and purposes, describe postulates as planning guides, and develop more systematic experiential learning sequences. While these efforts are encouraging, the 'sorting out' process needs to continue. (Fisher, 1981)
5. Any skill can be taught and learned. (Dewey, 1938)

Chapter 2

BACKGROUND LITERATURE

Experiential learning has had a long history and has been identified by many names. It has been called the "school of hard knocks", "learning the hard way", "hands on experience", "inductive" and "field experience" (Morine, 1973; Aronstein and Olsen, 1974). One theme of Plato in Meno was a boy who discourses with the teacher, drawing on his life experience to come to a new learning. Through the middle ages, experiential education was known as apprenticeship. In the 1900's, formal education included frequent misuse of experience, labor for its own sake without connection to any academic counterpart. This caused an increasing philosophical gulf between scholarly and manual work (Keeton, et al., 1976).

With the advent of the industrial revolution, formal education, previously maintained by the church, became the domain of the university. This further caused a division between experiential and formal learning. After the turn of the century, experiential learning began to be more carefully planned and required, as demonstration of acquired skills.

In the 1980's, the question of competency-based education has developed (Nickse, 1981; Niebuhr, 1981). Education is looking increasingly at student performance, which requires experience.

John Dewey spent his life writing about forms of experience in learning. Marie Montessori and Rudolf Steiner built entire curriculums for children based on experiential practices. Jean Piaget studied the effects of experience on children. From these foundations developed a movement toward a sense of cooperation between intellectual and experiential learning, and the recognition of individual learning modes.

> Experience: The nature of experience can be understood only by noting that it includes an active and a passive element peculiarly combined. On the active hand, experience is trying - a meaning which is made explicit in the connected term experiment. On the passive, it is undergoing. When we experience something we act upon it, we do something with it; then we suffer or undergo the consequences. We do something to the thing and then it does something to us in return: such is the peculiar combination. The connection of these two phases of experience measures the fruitfulness or value of the experience. Mere activity does not constitute experience. It is dispursive, centrifugal, dissipating. Experience as trying involves change, but change is meaningless transition unless it is consciously connected with the return wave of consequences which flow from it. When an activity is continued into the undergoing of consequences, when the change made by action is reflected back into a change made in us, the mere flux is loaded with significance. We learn something.
>
> Blind and capricious impulses hurry us on heedlessly from one thing to another. So far as this happens, everything is writ in water. There is none of that cumulative growth which makes an experience in any vital sense of that term. On the other hand, many things happen to us in the way of pleasure and pain which we do not connect with any prior activity

> of our own. There is no before or after to such experience; no retrospect nor outlook, and consequently no meaning. We get nothing which may be carried over to foresee what is likely to happen next, and no gain in ability to adjust ourselves to what is coming; no added control. Only by courtesy can such an experience be called experience. To 'learn from experience' is to make a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence. Under such conditions, doing becomes a trying; an experiment with the world to find out what it is like; the undergoing becomes instruction; discovery of the connection of things. (Winn, 1959, p. 38)

In reading through the experiential learning literature, there was a repeated emphasis on the problem of separation of experiential and formal learning, and the need for integration, both in theory and practice (Dewey, 1902, 1938; Keeton, et al., 1976; Tomlinson, et.al., 1978; Chiarelott, et al., 1979; Schoedler, 1981).

> Much of the learning that takes place in class proceeds through instruction, in which information or knowledge is transmitted from an instructor to the learner, while much of the learning that takes place outside class proceeds through acting or seeing another person act and then experiencing or observing the consequences. These different patterns may be called information assimilation and experiential learning. (Keeton, et al., 1976, p. 41)

"The basic difference between formal and informal learning is the difference in the quality of abstraction and the amount of language and symbols involved in the learning." (Dewey, 1938, p. 41) This aspect of language and symbols is important since the steps in experiential learning are different from formal classroom learning. In the formal process, information is transmitted through a symbolic medium of language. The first step in learning is receiving information. The second is assimilating and organizing it to provide

understanding of a generalization. The third step is to infer particular application of the generalization. The fourth step is the transfer from inference to action, i.e., application of information. Knowledge, to be useful, must be applied. Only when this step has been completed can we say a person has learned so that the initial information was of value and use (Keeton, et al., 1976; Gager, 1978; Steinaker and Bell, 1979).

The experiential learning process is nearly reversed in sequence from the formal process. In the first step, a learner carries out an action and then sees or perceives the effects of the action. These effects need not be viewed as either punishing or rewarding, but rather as information about a sequence of cause and effect. The next step is understanding the effects of a specific action or situation. The third step is to take this further and understand the general principle behind the cause and effect sequence. Thus, a range of circumstances can be included and the general principle applied. This implies the ability to perceive (though not necessarily verbalize) a connection between actions and effects over a range of situations. Finally, application of the principle in a new experience or circumstance occurs (Gager, 1977; Pearce, 1977; Steinaker and Bell, 1979).

Experiential learning has both strengths and weaknesses. Without formal learning with its use of symbolic systems, each generation would have to reinvent the entire path of civilization. A learner must have enough background experience for information to have meaning and reference points.

Bruner states:

> Teaching specific topics or skills without making clear their context in the broader fundamental structure of a field of knowledge is uneconomical in several deep senses. First, such teaching makes it exceedingly difficult for the student to generalize what he has learned to what he will encounter later. In the second place, learning that has fallen short of a grasp of general principles has little reward in terms of intellectual excitement. The best way to create interest in a subject is to render it worth knowing, which means to make the knowledge gained usable in one's thinking beyond the situation in which the learning occurred. Third, knowledge one has acquired without sufficient structure to tie it together is knowledge that is likely to be forgotten. (1960, p. 31)

In experiential learning, where the general principle follows the action, the resulting pattern in the memory involves more than principles and ideas for developing inferences. Memory seems to be enhanced by action taken and environmental response (Houston, 1976; Minor, 1977; Grimshaw, 1978; Joyce, 1978; Chiarelott, et al., 1979; Doran and Ngoi, 1979; Blakelee, 1980). The reason is theorized that the associations that place it in the memory are with concrete events (using the senses and motion) to which affect was attached, rather than abstract symbols.

Experiential learning often appears to be time consuming, particularly if much repetition is involved, and ineffective if there is a time-space difference between cause and effect. It can be difficult to verbalize, assess and evaluate (Willingham, 1977; Richter, et al., 1980). There may be difficulty on the part of the learner in generalizing from particular experiences to a general principle applicable in other situa-

tions. Perhaps it is because of this that post-experience discussions are seen as effective for enhancing and making conscious the learning process and effects (Gager, 1977; Presson, and Baker, 1980; Barber, 1981).

In elementary schools, experiential learning is not based in language symbols, which may be only partly understood or shared by teacher and learner. Variables in effective use of symbol systems include the child's age, cultural background, intellectual ability level, and (poor) prior learning of the symbolic skills. Thus, for a number of learners, experiential learning may be not only an advantage, but a necessity. Furthermore, activity is itself intrinsically motivating and rewarding. Action involves an investment of oneself, which creates a certain amount of tension. This tension is relieved when the action is successfully finished or resolved. The presence of another person in an interaction increases this effect. Challenge and adventure are intrinsically motivating and pressure-creating to the normal, curious child. Purpose is inherent also, though less obvious unless the planned experience is guided discovery rather than pure discovery; ensuring the "forward transfer of knowledge" (Barber, 1981). Dewey stated, "To reflect is to look back over what has been done so as to extract the net meanings which are the capital stock for intelligent dealings with future experiences. It is the heart of intelligent organization and of the disciplined mind." (1938, p. 19) He emphasized that

experience is always a transaction between oneself and the environment, each affecting the other (Friedman and Feldhusen, 1978; Barber, 1981). Thus each individual becomes responsible for personal choice of action and the response of the environment back to the individual.

During the 1960's, experiential education was sometimes described as learning completed with little or no help from the teacher. This is a misunderstanding of the real educational process, the difference between pure discovery and guided (goal-oriented) discovery. The teacher's goal is quality, with clear aims or objectives for developing an organized pattern. This aids the learner in perceiving order in both him/herself and the world (Mamchak, 1977; Linn, 1980). The teacher's role is to assist in regulating the childrens' experiences so they can discover easily and in an orderly manner for themselves. Thus, it becomes a cooperative team effort between teacher and learner.

Development of self-concept becomes involved at this point (LaBenne and Bert, 1969; Canfield and Wells, 1976; Beuke, 1978). Research in areas of self-concept are related to experiential education. Because experiential learning is concrete, it is seen as potentially constructive to self-concept. Self-concept affects academic achievement, and school success affects self-concept. Thus, experiential learning becomes a stepping stone to general improvement of academic achievement for learners below the norm (Sizemore,

1978; Della-Dora and Blanchard, 1979; Schunk, 1981).

Several factors affect experiential learning. Kinesthetics is a learning mode which affects many, especially young and minority learners. Other terms for it are "learning by doing" and "muscle-learning". Research in various learning modes is another area which has bearing on experiential education (Morgan, 1977; Simon, and Byram, 1977; Sizemore, 1978).

Chapter 3

METHODOLOGY

This literature search has included ERIC searches covering experiential learning and related descriptions from 1970 to March 1982, manual search of the New Mexico State University and branch campus card files of literature from 1970 to 1981, psychological abstracts and current professional periodical literature from 1975 to March 1982, and local libraries - Alamogordo Public Library, Las Cruces T. Branigan Public Library, Quimby Library (Southwestern College of Life Sciences).

Historically, concerns related to attainment of subject matter knowledge in experiential education have focussed attention on the integration of independent subjects and methodology of determining academic experience. (Dewey, 1902, 1938; Piaget, 1954, 1969). Several authors indicated that incorporation of first-hand relevant experience gives learners certain advantages over traditional passive listener-learners (Cross, 1976; Tomlinson, et al., 1978; Leff, 1978). An educational experiential activities matrix format for classifying and using already existing and identifiable sources of educa-

tion activities was developed in this study. Academic subjects have been represented across the top of the grid, in alphabetical order.

Much attention has been focussed on student skills perceived as necessary for individuals to succeed in our society, i.e., state minimum standards (O'Neil, 1978; Overly, 1979). Knowles (1975) presents a process of sorting and cataloging skills for the purpose of clarifying and redefining education. He states, "The purpose of education is the development of competencies for performing the various roles required in human life, . . . to help youth learn the skills of learning." (pp.11-12) To promote this, Knowles outlines a taxonomy of roles and their required competencies: Learner, Being a Self, Friend and Citizen. Other roles, such as family member, consumer, etc., can become subdivisions of these. These primary areas of skills, these roles, have been included as the vertical component of the educational experiential activities matrix. (Figure 1)

Using the matrix of role skills and academic subjects, exemplary activities have been sorted according to the competencies they are intended to develop in the learner. At least five activities from different sources have been presented in each section, representing different points of view and levels of complexity (1st through 6th grade). These activities included multicultural components, speci-

SKILLS: ROLES AND THEIR COMPETENCIES	I LANGUAGE ARTS	II MATH	III SCIENCE	IV SOCIAL STUDIES
A Learner Computing, conceptualizing, evaluating, imaging, inquiring, perceiving, reading, writing	Baratta-Lorton 1979 Caesar 1980 Fisher 1981 Hawaii S.D.E. 1981 Hillerich 1978	Ashlock 1978 Baer 1981 Caesar 1980 Fennell 1978 Masalski 1978 Stranix 1977 Thompson 1981	Anderson 1980 Blackwelder 1980 Crull 1981 Cunningham 1981 Evans 1981 Smith 1982	Benninga 1982 Horak 1981 Mamchak 1977 VanCleaf 1981 Young-blood 1979
B Being Self Expressing, goal-building, objectivizing, self-analyzing, sensing, spiritualizing, value-clarifying, health, responsibility	Berman 1982 Gilfillan 1978 Malkin 1978 Parke 1978 Sims 1981 Wantagh 1982	Alchin 1981 Avitol 1980 Campola 1981 Ockenga 1979 Sobold 1978 Sullivan 1980 Trusty 1978	Bricka 1981 Hammerman 1981 Newmann 1980 Schuncke 1980 Wright 1977	Bennett 1980 Clute 1979 Scalzitti 1980 Swafferty 1981 Tovey 1979
C Friend Collaborating, empathizing, giving feedback, helping, sharing, supporting, family managing, listening, loving	Ballirano 1977 Hemphill 1981 Mellion 1977 Polon 1979 Witman 1978	Bitter 1980 Burzler 1978 Gilfillan 1978 Harris 1977 Hunt 1978 Maletsky 1978	Flowers 1982 Keys 1980 Krulik 1981 Lohane 1977 Stanley 1979	Clute 1979 Fisher 1981 Gilfillan 1978 Newmann 1980 Wichita 1978
D Citizen Acting, caring, "conscientizing", having perspective (both historical and cultural), leading, participating, productivity	Carlin 1981 Ginsberg 1981 Hogue 1978 Loban 1979 Martin 1981 Tutolo 1981	Alec 1980 Tricks 1980 Solving 1982 Ginaitis 1978 Hoffman 1979 Kjellberg 1981	Bell 1978 Brunner 1980 Dawson 1982 Gilfillan 1978 Harris 1977 Harrison 1980	Gilfillan 1978 Henry 1980 Newman 1980 Phillips 1978 Zeitz 1979 Zenger 1977

Figure I
AUTHOR MATRIX

fically Black, Mexican-American and Native American. The activities have been presented and labeled in the order of the Author Matrix (Figure 1).

The Author Matrix demonstrates the interaction between academic subject fields and Knowles' areas of skill development. Within each block of the matrix the reader finds five or more authors listed, followed by a publication date. From each of these authors, an activity or group of related activities are presented in the same order as the authors in the chart. Subjects are main headings, with competencies or role skills as subheadings. There are four academic headings, each one with four competency area subheadings each with five activities from five different authors.

As a classroom teacher, the writer developed and taught a unit utilizing the philosophy of experiential education. Using one unit from a fourth-grade science text (Barufaldi, 1980), the writer planned and implemented a series of experiences with 40 fourth-grade students of multicultural classrooms. The description of these classes is found in Figure 2. The activities are presented as Chapter 4, Section 2. Results are given in Figure 3.

Finally, in reviewing the literature, conclusions and recommendations for use and research have been included.

AGE	NUMBER OF STUDENTS
9 years	9
10 years	27
11 years	4
	40 total

ETHNICITY	NUMBER OF STUDENTS
Asian-American	5
Black	3
Caucasian	26
Mexican-American	6
Native-American	0
	40 total

BOYS	GIRLS
8	11
9	12
17	23

FIGURE 2. DESCRIPTION OF FOURTH-GRADE STUDENTS. PILOT UNIT FOR AN EXPERIENTIAL CLASSROOM.

Chapter 4

CLASSROOM ACTIVITIES

This chapter presents activities to aid in developing student background experiences, and development and application of skills. Activities in the first section, Activities From the Literature, are condensed versions of the activities as presented by each author as shown in the Author Matrix (Figure 1). The second section, Pilot Unit for an Experiential Classroom, contains activities as demonstrated by the author and 42 school children.

Section 1. Activities From the Literature

I-A: Language Arts Learner Skills

Visual Memory (Baratta - Lorton, 1979, pp.120-121)

1. Skills: Strengthening visual memory; observing the position of letters in words; learning to read; reproducing words from a pattern; strengthening left-to-right progression.

2. Activity: The child "peeks" under a picture door on the chart by lifting up the tab to see the letters that spell the word for that picture. The student "spells" out the word by placing the letter cards in the pockets below the chart.

3. Comprehension: The teacher might discuss the activity by asking the student what the picture is, how to spell the

the word, to check, find the letters and try to do the activity from memory, saying, "Only peek when you really need to - try to stretch your memory."

4. Ideas for Follow-up: (Looking at a word where the letters are not in the correct order.) "What does this word say? Let's look under the picture and check to be sure the letters are in the right order. (Child looks). Are they the same? Can you fix it? I see a mistake in this word. Can you find it? How many letters are there? Can you tell me what letter 'horses' begins with? Can you tell me which word is longest --- shortest --- has the most letters --- the fewest letters? Which picture is your favorite? Practice this word for a while and see if you can walk to the board at the front of the room and write the word without forgetting the order of the letters."

Compound Word Match (Caesar and Caesar, 1980, p. 52)

Compound words are natural puzzles and students love puzzles. These three compound word activities capitalize on this fact; they differ only in the task. In the first instance a compound word is written onto a disc and then the disc is cut apart in a jigsaw manner which separates the compound word into its two elements. This style of two piece puzzle is a self-correcting teaching aid, either for small group or individual activity. The shape of the puzzle pieces are visual clues for the learners. The students can keep a record of how many compound words they "make" within a certain

time limit by writing the words. There can be a class list of compound words that is increased as students "discover" new ones after they have become familiar with the words in this compound matching activity.

The second puzzle format is an 11-inch square cut into 16 small squares. In this format only the individual words serve as clues since the cut lines are identical. Actually, the border squares serve as visual clues; the outside edge has no words because there are none to combine with to form compound words. This activity is a reinforcement of words already introduced, and like the first activity, is suitable for individual or small group participation. Children are usually required to record in their spelling books or on a piece of paper all the compounds they make with the activity. Some teachers also ask their students to write the compound word in a sentence.

The third activity centers on pairs of pictures. These pictures may be presented in pairs or given in bunches to students who then try to "make" pairs. In either way the compound word is recorded by the players. The prearranged pairing is one way to present the concept of a compound word to students. Once this is understood the large collection of individual pictures becomes a treasure for compound word discoveries. The selection of pictures from old workbooks includes both obvious items as net, ball, bird, and some more ambiguous ones like ladder, branch, animal. Thus, as students

work with these images they begin to learn about ways to combine words into pairs.

Touching, Living, Growing (Fisher, 1981, p. 85)

1. Write for information from the Department of Tourism or from the local and state Chamber of Commerce about well-known areas: national parks, historical places, etc.

2. Laminate a state map. Cut the map into six parts using the boundaries of six regions. Use as a jigsaw puzzle. Later, cut up each region to make a more difficult puzzle. This can also be done with U.S. maps.

3. Obtain a satellite landsat photo of your state from EROS Data Center, Sioux Falls, S.D., 57198. Cover the map with clear vinyl. By using a road map for comparison, find and mark with a magic marker the areas listed on the chart of state parks, lakes and mountains. Add major cities in your state. Perhaps the rivers can be located. When done, lift the vinyl from the landsat photo.

4. Make a mural depicting the birth of your state.

5. Braid a rug using strips of old material. Sew the strips in circles.

6. Ask your state senator or representative to visit your school and speak to your class. Write the person a thank you letter.

7. Prepare questions before and have a local judge speak to your class.

8. Investigate taxation. Find out the amount of city

tax. Figure the tax on a $6.00 Monopoly game. Figure the tax on your allowance for a year. What are some of the services bought with your tax money?

9. Compare/contrast: Look at rules for your school 20 years ago. Examine a list of your school rules.

10. Ask children how many have gone to kindergarten and first grade at this school. How many have gone to school in one or more other schools? Note the number on the chalkboard. Ask groups if they remember any classmates of this or previous years that moved to another place. Class pictures are helpful reminders of changes in the group.

11. Locate vacant houses or those for sale or rent. Show these on a floor/table map. How do these affect new people coming into our area?

<u>After a Field Trip</u> (. . ., Hawaii St. D. of Ed., 1980, pp.10-11)

Use Follow-up Activities and Plans:

1. The children write stories to go with the pictures that were taken of the activity. The children make a book, which includes drawings and stories focusing on interesting things about the trip.

2. The children share their stories with each other.

3. The children write thank you letters to the hostess/host of the establishment visited.

4. The children continue to do research in their assigned committees such as workers, transportation, history, uses of products, farming, etc., using and applying what they saw and

did on the trip.

5. The experiences and knowledge gained from the trip will serve as a basis for further planning for meaningful learning experiences. Parents will be invited to attend other field trips in the future.

Phonics - What About the Rules? (Hillerich, 1978, p. 94)

1. Children must know basic long and short vowels.

2. List examples verbally on the board or chart of other words using the sound designated (isolated).

3. Form groups of patterns; example - final e,ee,ea,eo.

4. Students (using free time) look in various books to find further examples of the specified pattern and exceptions.

5. Ask children to verbalize and generalize a "rule".

6. Discuss how this "rule" can help them, i.e. dictionary work and spelling. Some students may want to record their "rule".

I-B: Language Arts Being Self Skills

Making Spelling Sparkle (Berman, 1982, pp. 76-77)

Spelling is just about nobody's favorite subject (except for an occasional bright-eyed youngster who has the amazing ability to commit twenty letter patterns to memory just long enough to polish of the Friday test.) Is livening up spelling an impossibility? Let's just say it's a challenge

to creativity. Our readers offer you a few ideas to help you meet the challenge.

Jody Berman, a fifth-grade teacher, advocated attacking spelling tedium at ground level: The List.

Even if you're bound with tender ties of red tape to a grade level text, you can occasionally invite students to take part in creating an original spelling list for the week. Words may come from content material they are studying, from reference books they're using, or from their outside reading-- words that are functional and appealing (perhaps "fun" is too much to ask, though Mississippi comes close).

Hold a build-a-list conclave. Each student is to contribute a word, give its definition, and spell it for a recorder to write on the chalkboard. The class copies the word, but students are on their own to remember and write down the definitions given.

The study/practice projects for the week can be specially created, too. You might collect an assortment of word-study ideas that involve creative thinking as well as vocabulary enrichment and grammar, starting with these:

---writing fanciful dialogues or speech balloons for comics;

---using words in similes, and using the similes in poetry;

---preparing alliterative sentences for tongue twisters;

---providing humorous definitions;

---modifying words by adding prefixes and suffixes;

---recording syllabication as given in a dictionary;

---classifying words according to their parts of speech.

Your students may add ideas for special word-study activities. They're also likely to become alert for new and intriguing words to bring to the next create-your-own-spelling-list session.

Teacher's Handbook for the Outdoor School (Gilfillan, et al., 1978, p. 15)

1. Write letters to parents concerning the progress being made toward preparation for the Outdoor School or a field trip.

2. Prepare a log to be used at the Outdoor School. Prepare to write in it every day. Include feelings and thoughts as well as things you do..

3. Have students compose and read poems, haiku, or cinquains in regard to the out of doors.

4. Listen to the sounds of nature. Make a tape recording and identify as many sounds as possible.

5. Make oral reports and graphs on weather by studying the newspaper weather accounts. Collect reports and display.

Make It Up, Act It Out (Malkin, 1978, pp. 94-95)

1. Choose music which has mood and tempo variations, and three minutes long.

2. Ask students to listen and think of characters and a story that would follow the music.

3. Students divide into groups, two or three in a group.

4. Students have 30 minutes to develop a storyline, sequence.

5. Guidelines: simple story, characters interact, logical sequence of events, changes should follow music.

6. Students give performance and the audience critiques:

a. Was the story clear?

b. Did you understand the characters?

c. Did they work together and watch each other?

7. Variations:

a. similar exercise without music

b. similar exercise - each student is one character acting alone with appropriate dialogue, not describing actions, but feelings and thoughts.

Teaching Paraphrasing (Parke, 1978, pp. 87-88)

1. Students find a newspaper report or copy an encyclopedia passage, and have it ready for class.

2. Students underline key words and ideas.

3. Students rewrite to shorten article, using fewer words.

4. Students display for comparison.

Mystery Persons (Sims, 1981, p.70)

One subject your new class of students is sure not to have forgotten over the summer is themselves. Draw on this knowledge for an activity that puts each person in the spotlight for a while and helps the class get acquainted.

Ask each student to prepare a personal profile paragraph. Suggest that they organize the material about themselves from general to specific, including such information as age, physical appearance, family statistics, best and worst school subjects, interests and favorites (color, sport, song, entertainer, etc.). Have students sign their names lightly on the backs of papers. With younger children you might collect the information in an interview and write the paragraph from their answers.

Select a paragraph and post it with the caption, "Who's the Mystery Person?". You may wish to provide another clue by preparing a silhouette of each student for his or her stint as Mystery Person. Students read and ponder the paragraph, make their guesses on signed slips of paper and deposit them in a box provided.

Close the guessing session after a reasonable time and distribute a ditto with ten questions covering the various categories in the profile. For example: (this step can be done orally with younger children)

1. Is the Mystery Person a boy or a girl?
2. How old is the Mystery Person?
3. What color are the M.P.'s eyes?

When the students have completed the questions, go over it together in class following this sort of procedure: As the first question is answered, have all persons fitting that description rise; as each subsequent answer is confirmed, more of the original group will be eliminated until only M.P. is left standing. All who guessed correctly are winners.

Mystery Person paragraphs might be collected into a booklet, with photos for a "class book" look.

In-School Publishing of Books by Elementary Children (Wantagh Public Schools, 1982, pp. 48-49)

To spark student interest in reading, teachers in Wantagh, N.Y., were encouraged to help their children write class books for the Wantagh School Publishing Company. Manuscripts soon began trickling in. Finished books were edited, laminated, bound with a spiral binding, and put on display. Once students saw the bound editions, they all wanted to write books of

their own.

The school's reading lab soon became the Wantagh School Publishing Company's Write-In Center, where Kautzman offered kids guidance on getting started. Pointing out that being an author isn't easy, she told them they first would need an idea, and that they might have to do research. Then would come writing and often much rewriting until the text was perfect, followed by making sketches and deciding which one would be the best book cover. Next students would plan a dummy book with sentences and sketches laid out page by page. After receiving approval of the book, they would copy over the text in their best handwriting and do the final illustrations.

The children were told to write what they know about. The primary children were first to catch on to this technique, using a simple idea and writing about their everyday lives. The intermediate children were reluctant to try junior novels-- the type of book they read, so they were convinced to write for the younger children so the whole school could enjoy their books. Furthermore, said Gasparian, they discussed the art of writing a picture book and invited several picture-book authors to the school to discuss their work. These authors quickly dispelled any notions that writing picture books is babyish.

Today, 20 or more manuscripts come in daily, so there are many rejections. But they work with the students, says Kautzman; "We show them why we are returning a manuscript and help them to think about how they might improve on an idea or on their writing." Gasparian notes that no one seems to object to rewriting when it is suggested. In fact, the kids can't wait

to work on their books. The publishing company motivates kids to read and improve their writing and also enrich the content areas. Many third-grade stories were prompted by their science unit on the rain forest. Fourth-graders studying great Americans in history learned about writing biographies, autobiographies, and non-fiction.

Running the publishing company takes time. But thanks to the publicity efforts of Donald Sternbert, the assistant principal, 20 parents volunteered an hour a week to laminate, cut, and bind student books. With their support, the project has continued to gain momentum.

I-C Language Arts Friendship Skills

Use of Pantomime in the Classroom (Ballirano, 1977, p.195)

Have students portray character types such as golfer, archer, juggler, typist. Students pair off, face each other and take turns as "leader" and "reflector" and select vivid descriptive passages that one student mimes while the partner reads. Through such activities students observe and organize movements in a logical sequence, transforming abstract words and concepts into vivid images.

Language Arts Instruction: A Continuum of Possible Models (Hemphill, 1981, p.644)

The day begins in this primary classroom with twenty-eight students in a circle on the carpeted area of the classroom. Each student gets an opportunity to share a new joke or riddle, or tell about an incident that happened to them. The talk moves around the circle, almost every student taking a turn. Shannon, a six-year-old boy, tells about his dog that died the day before. At the end of the story Shannon can hardly talk for

holding back the tears. Ms. X says, "That's a very sad story. I'm sure you're sad because your pet has died. Do you have other pets?" Shannon nods. Ms. X asks the next student if she has something to share. Using a language experience approach these are written on individual charts and the children read them. What is real for the children now becomes their reading material, with meaning.

After the sharing time, with students still on the carpet, Ms. X takes time to remind students of the activities they may do during the morning. A theme that ties these activities together is "Bees":

---A handwriting exercise, copy a poem about bees.

---Draw and color a bee, labelling the main parts.

---Make a papier mâché model of a bee. Paint it when dry.

---Take a survey of classmates to find out which they would prefer to be, an ant or bee. Compare and later share findings.

---Write an original poem about bees. Put poems on bulletin board.

---View a filmstrip about beehives with a friend. Look at the real empty one that has brought into the classroom.

---View a filmstrip about bee "language" with a group of students. Discuss how bees are like people and how we are like bees.

---Write a story about bees by pretending you are a bee.

---Read a book from a special display center about bees.

Pen Pals Prevail (Mellion and Mellion, 1988, pp.83-84)

Beginning the study of letter writing is often not greeted with glee. To make it more challenging and interesting, teachers introduced a project that involved the kids in experiences they enjoy. As two teachers

in different schools, we "matched" or paired our students, based on their initial letters. Content was discussed: "What would you like to know most about your pen pal? What would you like your pen pal to know about you?" This became content for the first letter. Letters flowed back and forth. These could be written either in class or at home.

Then we arranged a trip for the two classes to meet. It became a mutual field trip to a museum. All the children had exchanged photos; so they readily recognized their pen pals upon meeting. It was an exciting day the children spent together going through the museum.

And best of all, the quality of letter writing of these children is significantly better than those simply confined to textbook basics.

Can You Get the Idea? (Polon and Cantwell, 1979, p. 92)

Give students copies of a situation story to read and ponder. Example:

"Our class had planned a school bus trip. My best friend and I were fighting about who would sit next to the window on the bus. Then,

"You chocolate worm," he called me.

"You cross-eyed toad," I called him. "I don't want to be your friend any more."

"I don't want to be yours either," he told me.

For my birthday he gave me a set of racing cars. Then we decided not to talk to each other any more.

The day of the trip finally arrived. The bus pulled up in front of the school. It was time to go. Our class boarded the bus first. My ex-friend and I waited at the door and glared at one another. Suddenly we both snapped our fingers and smiled. I told my friend he could sit by the

window on the way out and I'd sit there on the way back. He told me he had the same idea. So we shook on it as we stepped up on the bus. Then we started laughing. There were no window seats left."

Have students discuss various possible solutions the friends could have worked out. Many problem-solving situations can be found or created for solutions to be written out and discussed.

Colored Chalk and Messy Fingers: A Kinesthetic-Tactile Approach to Reading (Witman and Riley, 1978, pp.620-623)

The teacher lets each child choose a stick of colored chalk. Use a special-interest object that a child has brought-- a birthday toy, a bone found in a field, a rock collection, etc., to focus children's attention and thinking. Let children verbally compose a short story about the item. Next write the name or main work of the item on the board in each child's chalk. Each child then traces over the letters with his/her pointer finger. The children then watch the teacher write, and then they write the word themselves in their designated space at the board. The word is again pronounced and used in a sentence related to the story. Now the students continue with other words, on paper with a peer tutor. This buddy system helps both students practice words. We used a system of changing or rotating buddies once a week to provide variety.

I-D Language Arts Citizen Skills

The Turtle and the Children at Center Stage (Carlin, 1981, pp. 97-98)

From a simple event comes a lesson in writing dialog that is meaningful to the students and at the same time is teaching language skills. A great

variety of stimuli can provide conversation starters to be turned into written dialog. The teacher, Miss Mavis, does not view the children's excited chatter as so many interruptions; instead, she takes their language and uses it as a basis for an introduction to reading dialog.

Example: A child has brought something special to share with his classmates, his pet turtle. Miss Mavis joins the group of children gathered around Jeff. Already the children are popping questions:

"What's his name?"

"What do you feed him?"

"Will he bite?"

"How often do you feed him?"

"Where did you get this big bowl?"

Miss Marvis notes the children's interest, "Boys and girls, this is so much fun. I wonder if we could bring Tommy's bowl right over here to the front of the room. You have had so many interesting questions to ask Jeff. I would like to see what they would look like in print."

Quickly the turtle is moved to the front of the room. Miss Mavis writes: Jeff brought his pet turtle today. She steps back and reads it with the children. She ponders out loud, "Now what was it Mary asked Jeff?"

The children respond,"What is his name?" and Jeff responds, "Tommy."

"What did Jimmy want to know?" asks Miss Mavis.

Class: "What to feed him."

Jeff: "Turtle food."

Miss Mavis continues her queries, coaching her students until they

reconstruct their entire actual conversation with Jeff. Fully recorded on the board, it looks like this:

Jeff brought his pet turtle today.

Mary asked, "What is his name?"

Jeff said,"Tommy."

"What do you feed him?" Jimmy wanted to know.

"Turtle food," Jeff said.

"Can you pet him?"

"Oh, sure."

"How often do you feed him?"

"Once a day."

"Where did you get this big bowl?"

"I got it at the store where they have pets."

Miss Mavis has written each sentence as the children said it. The children see their speech transformed into printed form dialog. Miss Mavis draws back, appearing disturbed, remarking, "Well, what a fine story! I really enjoyed your questions and thoughts about Jeff's turtle. But you know, there is something that bothers me about one of your sentences."

"Which one, Miss Mavis?" asks a child.

"Well," the teacher says, "You know we were talking about feeding the turtle near the beginning of our story and then way down in the story we asked something else about feeding. I wonder if anybody could find the two sentences that ask about feeding the turtle?"

When the children had found the sentences, Miss Mavis asks, "I wonder if it would be alright to put these questions and their answers right

after one another." (Miss Mavis knows correct sequencing promotes good thinking.) The correction is made.

The children can now copy their group story. They may need to review how it grew out of everyone's contributions. Thus a lesson on dialog also becomes a demonstration of cooperation.

As illustrated here, the spontaneous and rich oral vocabulary of children provides teachers with a dynamic springboard for teaching reading and writing skills.

Shapebooks (Ginsberg, 1981, p.817)

Try "Shapebooks" for children's own story books: Most of the time children will read books written by themselves or other children. Interest is stimulated by creating the books in shapes. These can be shared with friends and family and create a special section of the classroom library.

To make a shapebook, help each child choose a title (see examples included). The child then cuts a cover of heavy paper and blank pages in a matching shape. The child can then record, perhaps with help, his/her ideas, first on practice paper, then on the book pages. Illustrations are encouraged. When finished, the book may be stapled or laced, using a paper punch and yarn. Students should be sure to sign their name under the title on the author page.

Some titles this author has found helpful are:

1. All About Me (child shape)
2. My Pet (animal shape)
3. Happy Birthday (cake shape)
4. What's Green? (tree or cloverleaf)

5. Time For ... (clock shape)

6. T.V. Favorites (T.V. set shape)

7. Things I Like (ice cream cone shape)

8. Football Stories (football shape)

9. My House (house shape)

My Life Without Electricity (Hogue and Simmons, 1978, pp.22-23)

Children might tape interviews with other students or community leaders, recording their views on today's energy situation. Play these back for the class. Devise a role-playing situation where one student interviews another who takes the part of an historical figure. Write or dramatize stories with titles such as "My Life Without Electricity". Add them to the classroom library. Any new vocabulary words could be listed on butcher paper and illustrated for a classroom dictionary, used as spelling words, or incorporated in crossowrd puzzles.

Older students can compose slogans such as "Don't shower by the hour" or "In day douse the light; it's needed most at night". Create posters using the slogans. It encourages purposeful rhyming and recognition of word patterns. Student poetry, riddles, or radio or T.V. commercials can inform consumers about the energy efficiency of a designated "product". Write letters to request pamphlets on energy conservation. It not only gives purpose to letter writing, but the students receive mail.

Let students debate or dramatize a situation where community leaders must decide which citizens will have access to limited fuel resources. Explore value judgments when ecological factors are at stake. Determine whether open windows and clear skies on hot days are more important than

air conditioning and polluted air. Discuss how energy crisis affects one's home life. These debate situations are an opportunity to teach about research and presenting a clear written statement of a position.

Children can read and write myths or stories describing the creation of various possible energy sources. These can be shared.

Commentary: Relationships Between Language and Literacy (Loban, 1979, pp. 485-486)

1. Students invite old settlers in their community to talk, taping their memories of the past, and prepare a booklet about early days.

2. Students talk to (interview) local famous people, politicians, veterinarians, specialists, and use this as a springboard for further reading, writing, and discussing.

3. Students conduct an experiment, growing beans in different pots. Each pot receives different nourishment: plain water, fertilized water, soft drinks, etc. Students keep a written log of their observations and measurements, and write epitaphs when the plants die. The focus here is on descriptive writing.

Folk Songs as a Language Experience (Martin, 1981, pp. 326-327)

As I observed the children enjoying our noontime folk festival, I realized the relationship of folk music to the language arts. As a result of singing, hearing, and reading folk songs, expressive and receptive vocabularies increased. As they sang "This Here Goat" (Brand, 1961, p.118) children learned new words. The words in folk song context gave important meaning to the children. Further practice was not necessary because through the folk song experiences the words became part of the children's permanent receptive, expressive language.

Folk songs became the basis for language experience stories. I asked the children to write about their favorite folk song. Ranging from one sentence stories, "I like the grizzly bear song" to more lengthy treatments, the stories reinforced the songs and the songs reinforced the stories. The children draw detailed pictures showing the bear chasing the unfortunate ranger around the woods and up a tree. These pictures and folk song content became the impetus for telling personal stories. Poignant songs were written about pets and family experiences. After one family tragedy, a fourth grader wrote and sang, "My dog ran away from home. And now I am all alone". The pathos of the words was reflected in the wailing melody she developed.

The guitar proved to be an excellent primer for developing word analysis techniques. Two sixth-grade boys, wise in the ways of woodlore but inexperienced in the ways of the printed word, were fascinated by the guitar but not by books. Words associated with the guitar became their sight words: guitar, strap, fret, neck, hole, wood, and steel. Consonant sounds were generalized from these same words. Reading blossomed.

Folk song content was intriguing to the children. Reading authorities report that content is an important variable in reading instruction. Gans states that "The child comes alive at words which convey ideas charged with interest for him" (1963, p.285). Robeck and Wilson (1974) conclude that interest is a powerful factor in reading comprehension. Using folk songs as content in reading class became an effective alternative to "Oh, look! See Mary run." The nature of these stories within folk songs provided fascinating content; motivation and interest were built in. They are from real people with real feelings in real times.

Interest in folk music sent children to the library. In their effort to find out more about the songs, they developed research skills. The card catalog became a familiar tool as they investigated song origins. Not only did the children find that folk songs originated in different places but they also found that folk songs of the same titles often reflected differing content. The children found that "This Here Goat" was mentioned in other sources as "Bill Grogan's Goat" and as "Old Hiram's Goat". The occasional problem of song line readability may be easily reduced. First, folk songs should be discussed. The universal nature of folk music enables the student to grasp the subtle and not so subtle meanings of content even though language patterns may be different from their own. These discussions develop an awareness of alternate language styles. Second, folk songs should be researched. By studying song origins and word meanings of another time, children gain insight into current word meanings.

Advertising (Tutolo, 1981, pp. 679-683)

There are three techniques used by ad writers to attract children's attention. One is presenting features or facts about a product in a way that makes a non-difference or unimportant difference seem significant.

Another technique widely used is to ignore or subordinate features and facts about the product and create advertising that is significantly different from competitors. "Brand X is the real thing" implies that other competitive brands are somehow less than real. Often celebrities present the products on TV for children's advertising, and these popular figures attract and hold attention. By repeating the advertisement over and over, it tends to become believable as witness the high volume sales for these products.

The third technique widely used involves claiming quality at a low price. In ads of this type emphasis is placed on quality, and often price is soft pedaled so as not to imply that lower cost means lower quality. Private brand advertising often uses this, for private brands tend to sell for less than nationally known manufacturers' brands. While these three techniques have been presented separately for illustration, copy writers often promote parity products by mixing the three methods.

To help children counter advertising claims, it is helpful to understand how advertising works. George Gallup, the famous pollster, has spent many years measuring advertising effectiveness. He pointed out that advertising almost always has three factors operating: a consumer need, a product to meet the need, and a price either stated or a price group implied. The buyer must balance these three factors when making a decision to buy or not. Advertisers should concentrate more on the need the product satisfies and less on the product itself (Gallup, 1974).

Here is how advertising works:

Needs: brings to consumer's attention a product or service that will meet his/her needs.

Product: tells consumer about special features over competing brands.

Price: may or may not point out price and/or price advantage.

How then can advertisers make special claims about product uniqueness and advantage when those may not exist in fact? What if the product is indeed a parity product, meaning it is identical or physically and functionally similar? How does an advertiser present the product, arouse a need, and convince the consumer to buy? In short, the advertiser does

this by making the consumer hear things that are not being said, accept as truth things that have only been implied, and believe things that have only been suggested. There are ambiguous words in the English language which ease this action. Wrightner regards these as weasel words, for they evade or retreat from a forthright statement or position. Below is a list of words commonly used by advertisers which are extremely effective in sales promotion:

Comparative Words

helps
like
virtual(ly)
can be
up to
as much as

feel/the feel of
looks like/the look of

Action Words

acts/works
refreshes
comforts
tackles
fights
comes on

Subjective Judgment

fortified/enriched
exclusive/different/special
style and good looks

Below is a list of persuasive words often used in advertising which are likely to catch the attention of children and encourage consumption. Consumption can be in the form of actual purchase by the child or influence on parents for purchase. These words, combined with certain motivating scenes which feature genuine news about a new product, endow the product with magic power, show someone wanting the product, show someone enjoying the product, or demonstrate the product's attributes in motion, have been found to be a powerful influence on buying behavior.

free	sensational	improved	challenge	last chance
new	remarkable	amazing	compare	it's here
suddenly	startling	now	bargain	just arrived
announcing	admirable	quick	hurry	important
introducing	magic	easy	the truth	development

Ask children to bring into the classroom print ads for the following products for which much children's advertising is often directed: cereal, baked goods, soft drinks, games, toys, and hobby/crafts. While these same products are widely advertised on TV, it is difficult for elementary teachers to video record these ads and play them in the classroom. Use of figurative language in print ads closely resembles that of broadcast ads, yet study and decision making is facilitated by the use of print ads.

Study these ads in the classroom, identifying weasel words and persuasive words. Then attempt to determine the real meaning of the words and phrases. Emphasize the importance of figurative language as a copy writer's way of comparing the product with something the children know, feel, and/or want. Ask the children to determine whether the product really is as wonderful as the ad suggests and list on the board claims the ad makes. Through discussion, arrive at conclusions about the value of the product.

In the second part of the analysis ask students to bring in comparative brands and products such as cereals. Make a careful analysis of the contents where appropriate, or otherwise compare one product with another. Point out the difficulty of identifying ingredients when initials such as PCT are used. These symbols and names are protected for use by the manufacturer. It does not mean that other comparable products do not have the ingredients, only that they can't call it the same name (PCT).

Ultimately the consumer must make a decision about a product advertised. This is critical reading/listening. Students should be led to the discovery of parity products or products which do not differ materially

from brand to brand. Students should be able to make decisions about products which they prefer and be able to tell why they prefer those products. Last, children should be able to identify products that will not meet needs and tell reasons why their needs will not be met. Examples: "Real differences exist and I prefer Brand x because ...", "This is a parity product and no real differences exist between these brands. I would choose this one because ...", and "This product does not meet my needs so I don't plan to buy it."

II-A Math Learner Skills

Smile (Ashlock and Washbon, 1978, p. 42)

Materials: Game board, die, markers, fact wheels (fact wheels can be constructed of lightweight cardboard circles; they are also available commercially), egg timer or stopwatch, and two sets of cards (one set of open addition number sentences, one set of open subtraction number sentences).

Rules:

1. To begin, each player rolls the die. The player with the highest number goes first.
2. The first player rolls the die, moves his or her marker as many spaces as shown on the die, and then draws a card from the addition set or the subtraction set as indicated on the space the marker occupies.
3. Once the card is drawn, another player sets the timer or starts the stopwatch. The player has five seconds to give the correct solution for the sentence on the card.
4. The solution is checked by moving the fact wheel to the appropriate fact and reading the solution in the window.
5. If the player has given the correct solution within five seconds, he or she moves the marker two additional spaces. If the player has given an in-

correct solution or does not give a solution within five seconds, no move is made.

6. Play passes to the left.
7. The first player to reach the large happy face at the end of the path is the winner.

Variations: Use multiplication and division number sentence cards and fact wheels. Omit operation signs from the board and color code the cards and spaces.

New Angles on Geometry (Baer, 1981, p. 12)

Proving that right angles, acute angles and obtuse angles exist outside the pages of the math text may simply be a matter of taking a new look at the classroom-- noting such items as the corners of floor tiles, the diagonals of braced shelves, the figures formed by clock hands as they make their daily rounds. Don't overlook two other readily available resources for angle tracking: the letters of the alphabet and the boundary lines on maps.

Have students sort out all the straight-line letters (A,E,F,H, etc.) and copy them on graph paper (the easier to judge the angles). Suggest that students use a color-code system to mark the angles they find-- for instance, red for right angles, orange for obtuse, blue for acute. Invite angle spotters to experiment with letter formations to achieve different combinations of angles. They might, for example, try making an 'X' with lines crossing to form right angles, then make an 'X' with two acute and two obtuse

angles.

Pose some challenges:

1. Which letters have acute and obtuse angles in them?
2. Can you write a word that has eight right angles in it?
3. What letters can you make with three acute angles?

Then set up an angle-hunting center with a set of maps (individual mark-on copies as well as posted maps, road maps, atlases) and a collection of tasks:

1. State Street and Mason Street come together to form what kind of angle?
2. Which state boundaries have right angles?

Students could also make maps of imaginary places with wonderfully angular boundary configurations. When you're looking for angles, geometry shows up in the most unlikely places.

Math Games (Caesar and Caesar, 1980, p. 30)

1. Bingo: various sizes, various purposes from simple number identification to math process (a multiplication problem in each square, teacher reads answers), to recognizing number names.
2. Dice: using three cubes of blocks, two marked with numbers, one with signs (-, +, x, ÷, >, <). Students roll by turn, complete the operation and the answer is their score. Students keep track of individual

scores. Final score to win game is determined by children's ages.

Percent: Bargain Collages (Fennell, 1978, p. 26)

Materials: a supply of old newspapers and catalogues.

1. Have students cut out examples of sales ads indicating price reductions in terms of percent discounts. (i.e. 10% off)
2. Students paste these on colorful large paper.
3. Have students determine the price, either original or reduced for each advertized item.
4. Answers can be checked with a calculator, and may be displayed with collages.

Open Ended Tasks (Masalski, 1978, p. 11)

Measure something this morning that will have a different measurement this afternoon. Keep a record of the measurement, and measure it again this afternoon. The world around us is filled with people, places and objects that have continually changing measurements. The height of a growing bean pod, the length of our shadow, and the outside temperature are but three such examples.

Measure the volume of some unusually shaped object. Find something that is growing and measure and keep a record of it as it grows. Find something you think is impossible to measure and measure it. Find something you have never measured and measure it in as many ways as you can.

City Streets (Stranix and Fleishman, 1977, pp.87-88)

Armed with tape measures, the kids walk the streets of a given area. They measure windows, doors, sidewalks, stop-signs, fireplugs. Each activity has a clearly-written set of directions.

1. Select three different sized windows along one street. Measure their length and width. Now determine the area and perimeter of each window. Find out how much these windows would cost, based on your measurements.
2. Choose three different size doors along one street. Measure the length and width of each. Now figure the area and perimeter of each door.
3. Using a meter (yard) stick, measure the front of a house. Measure the distance between the windows. Measure its distance from the street.
4. Measure the width of the street. Measure the width of the curb.
5. What materials are used to build houses and stores along this street? Find out how much these materials cost. How much would one wall cost? One building? (Measure all the walls.)

Many more activities can be developed.

A Single-Handed Approach to Telling Time (Thompson and VandeWalle, 1981, pp.4-5)

A simple sundial is a good introduction to telling

time and using clocks. The sundial gives children a good picture of the passage of time because of the changing position of the sun's shadow. The sundial also looks somewhat like a clock face, especially when numerals are written in to correspond to shadows at various times of the day.

A first activity is to make a simple sundial. The sundial is then placed in a south-facing window or outside. The sundial need not be permanent or stationary but its position should be carefully marked so that it can be placed in the same location the next day. The shadows are drawn in to correspond to various classroom activities during the day. Choose activities that occur at the same time every day: school begins, lunch time, recess, music, school ends. Label the shadow lines by writing the name of the activity beside the shadow line to which it corresponds. Then, on subsequent days when a regular activity begins, have children look at the sundial to see if the current shadow line corresponds with the one drawn previously. For several days the correspondence will be very close.

Next, use the same sundial and have children draw the shadows when the clock shows exact hour times. Good choices are 9, 10, 11, 12, 1, 2 and 3 o'clock. Draw and label these shadows with a different color marker than was used previously. Discuss with children that, as the shadow moves, the corresponding numbers increase in value. Then

question children regarding the times that daily activities occur. For example, "What time is it when we begin story time?" Stress terminology such as "about eleven", "a little after one", "about halfway between nine and ten", and "a little before three".

One Handed Clocks: Though sundials are a good introduction to telling time, they have inherent difficulties as well. Ask children why they would not want to depend on sundials for telling time. Some answers that children frequently give are, "What would you do when it's cloudy or raining?" "They are no good at night", and "Sometimes they are not exact enough." This discussion provides a good lead-in to the use of clocks, a time-telling device that's accurate and works even when the sun is not shining.

We suggest that the first clock to use with children is one that has only one hand-- the hour hand. There are several options for obtaining these one-handed clocks. The best is to buy a wind-up alarm clock or an inexpensive electric clock from a garage sale and then cut off the minute hand. Another good option is to obtain any clock and paint the minute hand a different color from the hour hand and then have children focus on the hour hand only. It is important that the one-handed clock be in working order.

Initial activities with this clock should be similar to the later activities with the sundial.

II-B Math Being Self Skills

Be A Number (Alchin, 1981, p. 12)

When a primary grade child is given his or her own personal number, math operations and relationships involving that number may be easier to remember. Prepare for a number draw, using several sets of the numerals 0 through 9. Have each child copy the numeral drawn onto a four by six inch card. (Be sure the children make their numeral large and bold so they can be seen easily.) If you wish, have the children attach their numeral cards to tongue depressors for easier handling. Have them tell about their number to class or small group.

Plight and Might of Number Seven (Avitol, 1978, pp. 22-24)

Have children write a short story about each number - how it would talk, act, feel; how it behaves in arithmetic; and what would happen if it walked into their house some evening.

Seed Swapping for Place Value (Cappola, 1981, p. 9)

Place value is a math basic. It can also be a puzzling concept that leaves many children wondering exactly what's being "borrowed" or "carried". The following seed-swapping game may help to implant the concept of place value in children's minds.

Materials for the game consist of corn kernels, sunflower seeds, pumpkin seeds, one die for each playing group of four, and a game sheet for each player. The game sheet

is simply a paper ruled into three columns labeled-- left to right-- Pumpkin, Sunflower, and Corn (i.e., 100s, 10s, 1s)

Before play can begin, children will need to know the seeds' swapping values, so write on board:

10 corn kernels = 1 sunflower seed
10 sunflower seeds = 1 pumpkin seed

The first player rolls the die and places the indicated number of corn kernels in the right column on his game sheet. Play continues around the group. For the second round, he places additional kernels on his game sheet, according to the number that appears on the die. When the total number of kernels in the corn column reaches 10 or more, the player must trade-- 10 corn kernels for one sunflower seed - in order to show his score correctly on the game sheet.

The game continues until one player had accumulated 100 points (equal to 10 sunflower seeds) to trade for the winning pumpkin seed.

After several games, a group might try using two dice for a faster game. Later, children may be ready to use the seed-swapping technique to work out borrowing and carrying problems. Successful seed swappers should find that place value is a basic they're ready to handle.

Graphs (Ockenga and Duea, 1978, p. 28)

1. Prepare a bulletin board labeled "Birthday Graph". Draw a grid and attach months horizontally and numbers vertically.

2. Have each child write his/her name and birthday on a piece of construction paper that matches the squares of your grid.
3. Each child pins his/her paper above the month of his/her birthday. These stack up over some months, creating a bar graph.
4. Variations include names, initials instead of birthdays or setting up individual alphabet graphs for each child's name.

Magic Squares: Concrete to Pictorial to Abstract (Robold, 1978, p. 40)

Materials: A square of cardboard, 30 cm. by 30 cm. marked off into nine 10 cm. by 10 cm. squares; forty-five buttons (Raid your box of discarded buttons for these.); Nine squares of felt, 7.5 cm. by 7.5 cm.

Preparation of the materials: Sew a set of buttons on each felt square so that there is a set to represent each number one through nine. It may be easier to identify sets greater than five if the buttons are arranged on the square so that smaller groups can be easily recognized. The buttons need not be all alike.

Activity: The student places each felt square on one of the squares on the large square grid, then rearranges them until there are the same number of buttons in each row, each column, and each diagonal. The student then makes a picture of the successful arrangement, and may wish to search for a different arrangement that is also successful.

This is Us! Great Graphs for Kids (Sullivan and O'Neil, 1980, pp.14-15)

September arrives, and the teacher has a list of the names of new pupils. Once again one is faced with the task of quickly learning everyone's name, of helping the children become acquainted with one another, and of easing individuals into their roles as one among others. Teachers are concerned with meeting the children individually, allowing them to be themselves and comfortable with their own self concepts, and yet helping each widen personal horizons as he or she adjusts to being a group member.

There are numerous activities that work toward these goals. Children on the primary level love to read, gather information, organize data, and exhibit their findings. Self-awareness graphs, by depicting the similarities between a child and his or her peers, can be an excellent way of helping children get acquainted in a classroom setting. Mathematics activities free children to think and provide an opportunity for children to discover patterns and relations. The youngsters delight in seeing traits that they have discovered about themselves and their peers represented in a graphic way.

Materials needed: crayons, tape, one sheet of construction paper for each student (about 10 cm. by 15 cm.), and one large (about 3 m. by 1 m.) sheet of white paper. The large white paper is fixed to the wall at a level the children can reach.

The initial activity, a student-made class portrait, centers around the group as a whole, with no classification noted. You can open the discussion with the question, "If someone asked what everyone in this classroom looked like, how would we show that?" At some point, a class picture would be suggested. Allow each child to draw a picture of herself or himself on a small sheet of construction paper. When the children finish their portraits, each will tape loosely her or his drawing anywhere on the large sheet of white paper.

A discussion of what they can learn by looking at the large chart would follow. The most easily determined information would be the number of students. This could then be written as an affirmative statement across the chart: We have 24 students in our class.

The teacher may ask, "How many boys are in our class?" This information is not easily determined from looking at our class portrait. So we remove all the boys' drawings and group them together on our portrait sheet. Boys pictures, and then girls, are taped in horizontal lines, reinforcing the basic left-to-right progression. After the boys and girls are charted in this fashion, a discussion can follow: "Which line of pictures is the longer? Are there more boys or girls in our class?"

The idea mushrooms and the excitement is contagious. Let's make more graphs! Hair and eye color can also be

charted. This time each child is given a happy face and asked to color the hair to match her or his hair color. To make a hair color graph, put numbers up the side 0-10. Put colors across bottom, leaving enough room for two bars per color; black, blond, brown, red. Make a bar each for girls and for boys over each color. The children put their own hair-color pictures on the chart under the appropriate hair color. To show eye color, children can color small pairs of eyes to paste on another chart.

Conclusion: The children may think of more ideas, such as graphing favorite ice cream flavors, etc.

Metric Round Robin (Trusty, 1978, p. 27)

Stations for various activities are set up and supplied with equipment.

1. length - students measure themselves and specified items around the room, and record their answers.
2. weight - with triple beam and balance scale, students weigh themselves and various specified items and record.
3. liquid - by sink, students pour water into a variety of containers and record how much each holds.

II-C Math Friendship Skills

Place Value Activity (Bitter, Mikesell, 1980, p. 283)

1. Two teams of about eight players each; in rows; one calculator per team.
2. Teacher writes a numeral on the board that has the

number of digits (eight team members = eight digit numeral such as 32,718,469), and explains the game. Variation: numeral may be erased to students so they have to listen.

3. The teacher calls out a digit from the numeral and the student (first in line) puts it into the calculator showing the correct place value. Example: '8' is in the thousands place so the student enters 8000 in the calculator.
4. The student passes the calculator to the next team member and the teacher calls another number for the students to enter in the correct place before passing it on. Example: Teacher calls '7'; the student now shows 708,000.
5. When the last team member puts in the last number, it should match the one on the board. Correct answer gets one point for that team.
6. After five rounds, team with the high score wins.

Be a Supershopper (Burzler, 1978, pp. 40-41)

1. Students bring empty food containers with store price tags still on. Alternative might be a trip to a local friendly grocery.
2. Students write out a shopping list.
3. Then they go "shopping" and write down on their list the price and weight of each item.
4. When they finish shopping, students total their pur-

chases to find how much they spent.

5. For students who are learning division, they can find per unit price of their items. price/weight.
6. Variations - how much would three cost can go on and on.

Outdoor School (Gilfillan and Burgess, 1978, p. 16)

Learn to determine distance by pacing. Measure one of your paces. Decide on a distance between two points. Pace it and record your figure. Then measure it with a tape measure. Compare to see how close you were.

Estimate and measure the width of creeks or rivers near the home or community, using the same process.

Estimate, measure, and mark out an acre of ground at the school.

Construct a water-tight box to illustrate what a cubic foot is.

Learn to read the barometer, thermometer, and other weather recording instruments.

Figure the cost of transporting youngsters to the Outdoor School.

Outdoor Education (Harris, et al., 1977, p. 9)

Set up a 50 or 100 meter track. Estimate and then measure with a stop watch or watch with second hand, the amount of time it takes each student to walk or run the distance. Find the average time it takes all students to walk or run the distance. Then determine the number of

meters per second each student traveled.

Have students measure the circumference of ten trees of different sizes. Use a tape measure or twine which can then be measured with a ruler or yardstick. Determine the average circumference of the tree measured.

Working in pairs, measure one square meter using colored toothpicks and string for marking the area. Inspect the area and compare with each other, the variety of things that can be found in one square meter of ground in a field or in the woods.

If large ants can be found running along the ground, measure the distance one travels for a short period of time (a minute). Measure the ant and find out how many body lengths were represented by the distance it traveled in the period of time. Determine how far a student would go if he traveled the same number of body lengths in the same period of time. Find the rate of speed (in miles per hour) that this would represent.

How High is a Flagpole? (Hunt, 1978, p. 28)

Formula for flagpole height: $\frac{\text{student ht. x pole shadow length}}{\text{student shadow length}}$

1. Have students in pairs measure various objects - fenceposts, trees, fireplugs, first by shadows and formula, then with meterstick if the object is short enough.
2. Later draw triangulation on board and explain principle: if two triangles are similar and the angles

of one are congruent to the other, then the sides are proportional.

Fibonacci Sequence (Maletsky, 1978, pp.39-42)

Start with a pair of rabbits born in January. One is male and the other is female. Then assume that:

a. rabbits begin to bear young two months after their own birth, and

b. after reaching an age of two months, each pair of rabbits produces another male and female pair each month thereafter.

MONTH	NUMBER OF PAIRS
January	1
February	1
March	2
April	3
May	5
June	?

This birth pattern leads to the sequence of numbers called the Fibonacci sequence. It is named after Leonardo Fibonacci, an Italian mathematician who lived in the Middle Ages.

1. Complete the diagram and find the number of rabbits for June.
2. What is the next number after that in the sequence? What is the rule for finding the next number in the sequence?
3. How many rabbits will be born in December? How many rabbits will there be in all at the end of the year?

4. Complete these sums of consecutive Fabonacci numbers.

1 + 1 = _____

1 + 1 + 2 = _____

1 + 1 + 2 + 3 = _____

1 + 1 + 2 + 3 + 5 = _____

How are these sums related to the original sequence?

II-D Math Citizen Skills

Building a Metric City (Alec, 1980, pp. 37-39)

In the intermediate grades, much more flexibility, creativity, and responsibility can be given to students. The role the teacher might assume is that of guiding the students. The task outlined for the group of students might be stated in terms such as, "You are to recreate your town or a portion of your city using these blocks for your buildings (show blocks of various sizes). If you use this size block to represent a house (show a block of intermediate size), would you use a block like this (show a smaller block) to represent an apartment building?" These and other questions asked by the teacher will create a group awareness of the many aspects the group needs to consider in constructing their 'town or city': "If this block (hold up a block that might appropriately represent a house) represents a house, how wide will your streets be? How will you represent other types of buildings on your map?

What will you put in your legend? What will you need to represent the distances?"

An alternative approach to the recreation of a part of an existing community is for students to have the opportunity to plan and represent a town of their own. This approach allows for student creativity and group planning. Students need to be aware of the various components that make a town a town or a city a city. Questions similar to the previous activity need to be asked, but questions also need to resolve some other concerns: "Is the shopping center located so that it is accessible to customers? Are there sufficient customers to support the large shopping center? Is there adequate transportation? Are the roads sufficient? Where should the school(s), factories, and so on, be placed?"

Depending on the students' skills and maturity, various mathematics skills can be taught, reinforced, or applied. Problems can be created for students to solve: "If a residential home has an average of four members in the family, what is the total population of a subdivision of a city or of the total town?"

Language arts skills can be extended for the intermediate grades, as well as skills in social studies. City government could be incorporated into the city planning and students could role-play and follow decision-making models in the building of their towns.

The reading of maps is another skill that could easily be applied and learned. Students could be assigned the task of determining the actual directions and distances from one destination to another. Measurement techniques may be applied to a variety of situations. Arts and crafts can be used to "beautify" the final product, their own city.

Conclusion: This "model" planning is a learning experience that draws upon the various disciplines and is an excellent culminating activity. It uses and develops many mathematical skills and can be used to apply metric measurement skills. It is a creative activity which can be adapted to many different levels and which students enjoy. The limitations are set only by the imaginations of the participants.

Metric geoblocks can be purchased commercially, but should funds be limited, scrap pieces of lumber from a shop class or a lumber yard could also be used with few limitations. The basic competencies of measuring, estimating, and the skill of conversion within the system can be applied to both sets of materials.

Tricks or Treats (. . ., Arithmetic Teacher, 1980, p. 31)

Children can dress up and act out this set of story problems. It's great fun!

Recipe: Witch's Brew: For every two frog legs, use four dried black snakes and six bat wings. Information:

lizard ears = packs of two for 40¢; bat ears = packs of three for 50¢.

1. Wanda Witch will cast your future for 20¢. For her spell, she mixes a brew. Dried snakes cost $1.40. Walter Warlock paid for one snake with quarters, dimes and nickels. He used 14 coins. How many of each coin did he use?

2. Wanda is going to use six frogs. How many snakes and wings will she need?

3. Walter is going to use seven frogs. How many snakes and wings will he need?

4. Wilma Witch bought a total of 18 ears. How many of each kind could she have bought?

5. Walter Warlock spent $4.00 for ears. How many could he have bought?

Solving Real Problems (. . ., Arithmetic Teacher, 1982, p. 14)

In the course of a typical primary-school day, many opportunities arise very naturally for using mathematics to solve problems that are "real" to children. When children see a need to solve a problem, they are often willing to expend a great deal of time and effort to solve it even if it is more challenging than any problem in their mathematics books. The teacher plays a central role not only in making it possible for the children to spend time on real problems that arise, but also in serving as a facilitator to encourage such useful problem-solving tech-

niques as understanding the problem, relating the problem to a simpler problem, encouraging different ways to solve the problem, and checking the solution.

As an example, one morning a second grade class may receive a large roll of corrugated cardboard. The teacher must share the cardboard with the other three teachers at her grade level. She asks the children to help her decide how to do this. First, she clarifies the problem. How many teachers have to share the cardboard? She lists the names of the teachers. How should it be shared? One child suggests each teacher could cut off a piece, but another child realizes that might not be fair. One teacher might be greedy and take too much. How could the cardboard be shared fairly?

The teacher suggests solving a simpler problem. She gives the children strips of paper and asks them how they might cut the paper into four pieces all the same size. (like fraction work) The children come up with two ways to do it. They then test the two ways.

The children suggest folding the cardboard as they did the paper. Two children fold the cardboard while a third cuts. They soon realized which method (folding in the same direction twice) would be easiest method to use with this roll of cardboard. Once they have the four sections, the teacher asks how they could show that the sections were the same size. The children place one section on top of the

other, showing that all four sections are exactly the same size. A few of the children then deliver the sections of cardboard to the other three teachers, assuring them that the roll of cardboard has been shared fairly.

This sort of problem is probably more meaningful to the children than any textbook problem and, with the skill of the teacher, the children are guided into the use of effective strategies.

Sense with Cents (Ginaitis, 1978, p. 43)

Cut out pictures of coins from old, discarded books and workbooks. Paste these to cardboard cutouts. First children need practice in identification and relationships of coins. Make as many sets as possible. (Minimum ten pennies, five nickels, five dimes, four quarters, two half-dollars. Dollar bills are optional.) Using small toys and items or pictures of them, set up a buying game. Pairs of students, one buyer, one seller, make "purchases" and change. Discuss with students ideas of shoplifting and store loss. As these materials are used, other variations may become apparent.

Bridging a Gap (Hoffman, 1979, p. 18)

One of the most rewarding experiences a teacher can have is that of watching youngsters use their rich imaginations in the solutions of a problem. Each year at our school the fifth and sixth graders are given the opportunity to apply their creative powers in the construction of bridges

according to certain specifications.

Requirement for Construction: The bridge must span 25 centimeters and must be a minimum of six centimeters wide. Each child is given a set of building materials:

Six sheets of tagboard, each 18 cm. by 28 cm.
Six paper straws
Six pieces of string, each 30 cm. long.

Each child is also asked to provide herself or himself with a ruler, a scissors, a pencil, and a bottle of Elmer's Glue. These are the only materials that they can use. How they combine the materials is up to the individual children.

The task is to build the strongest and most economical bridge possible. Imaginary costs are assigned to the building materials. The tagboard (structural material) costs $50,000 per sheet; paper straws (steel reinforcement) costs $10,000 each; and the string (steel cable costs $5,000 for 30 cm. The children may use any or all of the materials provided. They must keep in mind, however, that the more materials that are used,the higher the cost of the bridge.

Background Building Information: Before the actual construction begins, the children are introduced to the work of Frank Lloyd Wright, Wisconsin's most famous architect. Slides and pictures of some of his structures are shown. This gives the children an opportunity to see what an architect with some imagination can do. Through slides and pictures the children also see various types of bridges.

They learn some new words, from the vocabulary of bridge building. They also see a film loop on the Tacoma Narrows Bridge collapse, with its implications for lives and community safety.

Actual Construction: Each child must make a working drawing of his or her bridge before the actual construction takes place. This drawing will guide the child in the construction of the bridge. All construction is done during classroom time.

When a bridge has been completed, the builder must make out a cost sheet that includes all the materials used in the construction of the bridge. The children are encouraged to name their bridges.

Testing the Bridges: Two pails of rocks, fist size or smaller, are gathered by the teacher or the students. These rocks are individually weighed and each is marked as to its weight.

The bridge is placed on a support stand and the stand is then placed between two desks or tables. A small piece of wood (about 3 cm. by 2 cm. by 10 cm.) with a screw eye attached at each end is laid across the bridge. A chain is attached to the two screw eyes and a pail is then hung from the chain. The pail and stick must also be weighed before any bridges can be tested.

After the pail is in place, rocks are slowly added to the pail. As each rock is added, a running total of the

weight is kept. This continues until the bridge collapses. The bridge able to maintain the most weight wins. Much discussion and future preparation follows this activity.

Pizza (Kjellberg, 1981, p. 195-197)

Students can work with data from the world around them. They can see and generate problem solving, relationship and equations. More interest is created by having students use real prices and menus from local pizza establishments. Follow up with a pizza-lunch field trip.

Students can generate and solve price equations for each of the sizes of pizza seen in Table 1. Two columns could be added to Table 1: one for the equation and one for the cost of the Super-Duper pizza.

Once this part of the lesson is completed the students can calculate the price of a Super-Duper pizza on a cost-per-square-centimeter basis (based on the large size prices). Which of the two methods gives a lower price on the Super-Duper pizza? See Table 2.

TABLE 1

Type of Pizza	(30cm diam.) Small	(40cm diam.) Medium	(50cm. diam.) Large
Cheese	$2.82	$4.37	$6.17
Sausage & Mushroon	3.93	5.92	8.16
Shrimp	4.13	6.31	8.54
Green Pepper	3.06	4.61	6.65
Pepperoni	3.54	5.34	7.38
Canadian Bacon	3.79	5.83	7.86

Table 2

Type of Pizza	Total Price	cm^2	Price/ cm^2	Total Price
Cheese	$8.22	2826	$0.0031	$ 8.76
Sausage & Mushroom	10.65	2826	0.0042	11.87
Shrimp	10.82	2826	0.0044	12.43
Green Pepper	9.21	2826	0.0034	9.61
Pepperoni	9.69	2826	0.0038	10.74
Canadian Bacon	9.88	2826	0.0040	11.30

Note: A Super-Duper pizza is 60 cm. in diameter.

III - A Science Learner Skills

Solar Walk (Anderson, 1980, p. 107)

How far is it from Earth to the sun? How much farther is Pluto from the sun? These distances can be shown with diagrams and models, but they come into more dramatic focus when the class goes on a solar walk.

First prepare labels for the sun and each of the planets. Then assign the tasks of "planet markers" and "distance pacers" to various students and move the class out to the playground. (Labels can be held or chairs brought out and used as temporary signposts.) The first distance pacer begins moving away from the sun using baby steps. Explain that each baby step represents one million miles. After 36 baby steps, the student holds his position while another student posts the Mercury label. Thirty-one baby steps from Mercury is Venus. From there, it's 26 steps to Earth. Use the following chart as a guide to solar walk distances:

Distances from the Sun in Millions of Miles

Mercury	36
Venus	67
Earth	93
Mars	141
Jupiter	484
Saturn	887
Uranus	1,780
Neptune	2,794
Pluto	3,658

At Mars, one may wish to speed the process along by switching to the "giant step" mode, with each step repre-

senting ten million miles. If the playground is small, students may wind up pacing into a nearby neighborhood to cover the distance to Pluto.

Although this project is hardly compact, neither is the solar system. Perhaps the vastness of space will become more real as children pausing on Saturn find themselves nearly 90 giant steps from neighboring Uranus. Science for All Seasons (Blackwelder, 1980, pp. 55-56)

Purpose: To discover what some frogs, turtles, or salamanders do when cooler weather comes.

Materials: An institutional size jar or an aquarium half filled with mud and filled to the three-quarter mark with water. Let the mud and water sit in the jar overnight, and the next day add ice cubes in order to bring the water level nearly to the top of the jar. Add the ice very carefully so as not to stir up the mud. A frog, turtle or salamander.

Let the children feel the water in order to establish that it is cold. Ask them to think of the water in the jar as water in a pond when cold weather comes. Place the frog, turtle, or salamander in the cold water. Eventually, it will dig through the mud to the bottom of the jar or aquarium.

Let the children collect a variety of fall leaves and then categorize them according to color - all the red leaves in one pile, all the orange leaves in another pile, and so

on. Use fall leaves to make stained glass windows. Cut two sheets of wax paper approximately 8" x 10". Let the children arrange the leaves between the wax paper sheets. The adult may press the wax paper with a warm iron to make it cling together and hold the leaves in place. The children may mat their projects with frames made of construction paper. Hang the finished projects in front of a window to allow sunlight to shine through.

In order to help children understand how trees grow new leaves in the spring after losing their leaves in the fall, force buds open from a variety of trees. After at least six weeks of cold weather, remove budded branches and bring them indoors. Keep the branches in water in a warm, sunny place. In three or more weeks (depending upon the type of tree from which the branches were removed), the buds will open to reveal new leaves. Note: The earlier the buds on a tree open in the spring in a natural setting, the earlier they will open indoors.

Growing Lead Crystals (Crull, 1981, pp. 30-31)

Third and fourth grade students will be delighted as they grow their own crystals in the classroom. Not only is the procedure safe, simple, and inexpensive, but also it allows a rapid initial crystal growth followed by a longer period of slow growth and is adaptable to different teaching strategies.

Begin by providing students with equal volumes of two

liquids labeled I and II, each in a transparent container such as a test tube, petri dish, or baby food jar. Have them follow these instructions:

Day One

1. Pour one liquid into the other.
2. Pour the resulting liquid back and forth several times between the two containers to make sure the two liquids mix.
3. Pour all of the mixture into one of the containers and let it stand overnight.

Day Two

1. Observe what has happened to the mixture.
2. Drop a piece of zinc into your mixture and watch for a few minutes to see what happens.
3. Examine your container once or twice during the day, then let it stand overnight.

To increase suspense and to encourage hypothesizing, ask students what they think will happen. Do they smell anything? What does it smell like? Some students will relate the smell to the vinegar in oil and vinegar salad dressing. Other students will make predictions that are based on little or no evidence only to discover the next day that their solutions have become gels.

On the second day, act surprised that the solutions gelled. Ask students how they think it happened. Have they ever seen anything like it before? Inevitable, some-

one will draw a parallel between the gel and Jell-O.

Ask students what will happen if they push a piece of zinc (a small piece of zinc less than a gram will do) under the surface of the gel. Within seconds, the zinc grows a "hairy black beard". Lead crystals literally grow before the students' eyes. Make a point to tell students that what they see growing are crystals of lead. Because they originally added zinc to the gel, they naturally ask questions about the appearance of the lead. Ask students where they think the lead came from? Did the zinc turn into lead? If students ask how you can prove that the "black beard" is lead, dissolve the lead filings and test with achromate. The formation of orange color precipitate is evidence that the filings on the zinc are lead. Students do not need to describe the mechanism of the zinc-lead exchange. They should, however, ask questions about the phenomenon they observe.

The day after adding zinc, encourage students to compare the sizes and shapes of their lead crystals. Ask students to draw pictures of what they see in their containers.

Growing crystals generates enough excitement that many children tell their parents what happened when they added the zinc. Encourage students to take their crystals home--it is good public relations and eliminates a lot of cleaning up. Some students, if they know how, will grow sugar crystals (rock candy) at home. To help, give each student a

copy of the sugar crystal growing procedure available from library science books to try in their home kitchen. The number of students who report their success or failure growing sugar crystals is a good measure of your success in generating excitement about crystal growing and science processes.

If you feel a lack of expertise in finding the reagents or mixing the solutions, ask your local science resource person or high school chemistry teacher to prepare the solutions. All that remains is an enjoyable laboratory experience for your class.

Teacher Preparation: To prepare solution 1, use a hydrometer to measure specific gravity and dilute water glass (sodium silicate NaH_2O + S + Pb-Pb) to a specific gravity of 1.06. Store this solution in clean glass bottles or jars. If no hydrometer is available, dilute the water glass until one liter (L) has a mass of 1060 grams.

For solution II, prepare a 1 N (normal) solution of acetic acid (60 g of glacial acetic acid in 940 cm^3 water). Make this acid solution 0.05 N (normal) to lead acetate by adding 19 g of lead acetate to each liter of the 1 N (normal) acid. This lead acetate-acetic acid solution should also be stored in clean glass bottles.

A Simple Experiment to Find the Rate of Water Uptake in a Shoot (Cunningham, 1981, p. 48)

A piece of wide bore glass tubing is filled with water,

the specimen places in; and then a thin layer of oil is floated on the surface. The oil prevents water loss by evaporation from the surface. The water level is then marked.

The burette is filled to the zero mark and again a thin layer of oil is floated on the surface. The time is noted and then the apparatus left for a suitable length of time (dependent upon nature and size of specimen). As water is taken up by the specimen, the level of water in the tube drops.

By releasing the punch valve on the burette, the water level in the glass tube can be returned to the original mark. A direct reading from the burette will then give the amount of water taken up by the specimen. By noting the time at the end of the test, the rate of water uptake can be calculated by using the following formula:

$$\frac{\text{Burette reading}}{\text{Time of test}} = \text{rate of uptake of water}$$

The advantages of this piece of apparatus over the traditional potometer are many-- the most obvious being the lack of watertight seals and the fact that specimens of any size may be used. Also it is cheap, an important factor in modern science education.

Silkworms: Raise Your Own (Evans, 1981, p. 44)

What began several years ago as a just-for-fun project in my classroom has become an annual science event

that always intrigues children. Raising silkworms is as easy as it is enriching. The children love seeing for themselves the metamorphosis of a tiny silkworm egg into a creamy white moth, and they discover firsthand the source of silk. The project also motivates the children to read everything they can find about silkworms and silk.

Materials: silkworm eggs, which should be stored in an airtight jar in a refrigerator until you're ready to hatch them (Sources of eggs are listed at the end of the article). Also needed are mulberry or Osage orange tree leaves, which the young silkworms need to eat (Various kinds of mulberry trees grow throughout most of North America; Osage orange trees may be found in many states.), a large cardboard box, aluminum foil, paper towels, small sable paintbrush, cardboard egg cartons, plastic wrap.

Procedure: As soon as small leaves begin to appear on the mulberry or Osage orange trees (around the first of April, as late as May in northern regions), remove the jar of silkworm eggs from the refrigerator. Open the jar and lay it on its side in the cardboard box (so the tiny worms can easily crawl out when they hatch), which has been lined first with aluminum foil and then with paper toweling. Place the box in a draftfree area of the room, away from direct sunlight and heat. Mark the date on the calendar so that students can see how long the eggs take to hatch (usually from ten days to two weeks). During this waiting

period you can read books about silkworms.

When the silkworms are almost ready to hatch out, the eggs will become rather flat instead of round and will have a slight indentation in the middle. (As the worm matures, it curls into a circle.) As soon as they begin to hatch out, pick a few small, tender leaves from the mulberry or Osage orange tree. Wipe off dust or moisture from the leaves, and lay them in the box. Then take your sable paintbrush and very gently brush the tiny worms onto the leaves. They will begin eating immediately and will eat constantly for the next four to five weeks-- except for the times when they shed their skins.

Each day for about a week, new larvae will hatch out, and you will need fresh leaves to feed them. For about the first two weeks you will need to gently brush the worms from the old leaves onto the new leaves. When the silkworms begin to turn grayish and are larger, you may gently pick them off and put them onto the new leaves. (It is important to provide young silkworms with new leaves each day, including weekends, and to change the paper toweling often.)

After four to five weeks, when the silkworms are about three to three and a half inches long, they'll begin to crawl restlessly around and to sway back and forth. This means they are looking for a place to spin their cocoons.

At this point, transfer the silkworms to the egg cartons (opened out), and place one or two leaves in each section.

Cover the cartons with plastic wrap to prevent the worms from crawling out. (Or you may give each child a small box lined with paper toweling and a few leaves, and let the child choose her or his own silkworm to observe.)

When the worms begin to spin their cocoons, they need a quiet room, or they will stop spinning and just crawl around. You can encourage students' cooperation by pointing out that when they're very quiet, they will actually be able to hear the silkworms chewing the leaves.

Observing the worms spinning their cocoons is one of the highlights of the project. First the worm secures itself in a "hammock" of yellow or white silk that comes out of the spinneret from tubes on each side of its mouth. Then it takes about one day completely surrounding itself with silk. For the next three to five days it makes one figure eight after another of silk until the cocoon is complete. It remains in this pupa, or transformation, stage for about two weeks.

The first sign that a moth is about to hatch out is a dark wet spot at one end of its cocoon. Then slowly the moth will emerge, with its feathery antennae appearing first. As soon as several moths have completely emerged, put them into your original cardboard box, from which the paper toweling has been removed and only the aluminum foil lining remains. The moths in this large box will flutter about (but not fly away), mate, and the females will lay their bright

yellow eggs on the foil. One female can lay as many as 400 eggs, but most of them lay about 100. After about a week, the moths die.

To show children how silk thread is taken from a cocoon, take at least a dozen cocoons, place them on a baking sheet and bake them in an oven at 200° for 20 to 30 minutes. Put the baked cocoons into a pan of water, boil for 20 minutes, and let stand in water for 15 to 20 minutes, allowing water to cool. Then, with the cocoon still in the water, let each child try winding a silk thread from a cocoon around a pencil.

Finally, go back to your cardboard box of eggs. Gradually the fertile eggs will have turned darker. Carefully scrape them off the aluminum foil into a clean, dry jar and seal with an airtight lid. Label the jar and put it in the refrigerator. Then early next April, when the mulberry and Osage orange trees begin to leaf out, you'll know it's time to reinstitute your annual silkworm-raising project.

Resources: The best time to order silkworm eggs is early spring, when the danger of freezing during shipment is past.

Jean Case, Fallbrook House, RD2, Box 17, Troy, Pa. 16947 For 100 eggs, send $3. No charge for postage and handling.

Marjorie K. Evans, 8233 Nada St., Downey, Ca. 90242. For 50 eggs, send $2.25 plus $.75 for postage and handling. For 100 eggs, send $3.25 plus $.75 for postage and handling.

Idea Bank: Tin Can Differential Thermoscope (Smith, 1982, pp. 56-57)

The absorption and emission of heat from black and shiny surfaces can be compared by constructing a simple device employing the principles of the differential thermoscope invented by Count Rumford. Sutton describes a variation of this apparatus.

Collect three empty 1 gallon metal cans (the type commonly used for spirit duplicator fluid work well). Paint one broad side of each can with flat black paint. With steel wool, rub paint remover on the opposite side of each can until only the shiny metal is visible.

Plug the spouts of two of the cans with tight-fitting, one-hole rubber stoppers into which a short piece of glass tubing has been inserted. Connect a piece of flexible plastic tubing to each of the glass tubes. Join the plastic tubes with a horizontal section of glass tubing, that contains a small bead of colored water centered in the tube. (The horizontal glass tube may be supported on a ring stand.) Make the plastic tubing long enough so that the cans can be rotated easily.

The water bead in the glass tube will respond to small differences in air temperature in the cans, moving away from the can with the higher temperature. As the temperature of the can itself increases, the kinetic energy of the air molecules inside increases, causing the molecules to

move more and more rapidly away from one another. As the air expands, its molecules exert pressure on the bead of water, forcing it to move.

To demonstrate these principles and to show how the apparatus works, place your hand lightly on one of the cans. This will raise the temperature sufficiently to make the bead move.

With the cans set 40-50 cm. apart, place an incandescent lamp midway between them with the black surfaces of both cans facing the bulb. The bead will remain stationary because both surfaces absorb the same amount of heat.

Now turn one of the cans around so that its shiny surface faces the bulb. The bead will move quickly away from the can whose black surface faces the bulb because the black surface absorbs more heat than the shiny, more reflective surface. The bead can be made to move in the opposite direction by simply turning both cans 180°.

Next, fill the third can with very hot water; place it midway between the other two cans so that the black surfaces of the outside cans face the middle can. The bead will move away from the can facing the black surface of the middle can because the black surface of the middle can emits heat better than its shiny surface does. If the outside can that is facing the black surface of the middle can is turned around, the bead will stop and remain stationary because the combinations of black emitter-shiny absorber and shiny emitter-

black absorber are equally effective in transmitting heat.

You might wish to experiment with other arrangements or to perform this experiment as a demonstration, asking the students to make predictions and draw conclusions from the behavior of the system.

III-B Science Being Self Skills

Studying Our Bodies (Bricka, 1981, p. 24)

"Hey, Tom, you just glued your femur over your patella," ten-year-old Kelly said to his friend. "Now how are you going to bend your knee?" These fifth-grade students were culminating a unit on the human body.

Ten year olds have little trouble understanding how their arms and legs fit together and move. But few have any concept of the shapes, positions, and relative sizes of their internal organs and bones. To help fifth graders develop an internal body awareness, we ended our study of the human body with a major hands-on project.

We began by tracing the outline of each child's body onto a large sheet of craft paper. Next we listed all the things to be included within the outline-- brain, esophagus, lungs, heart, ribs, stomach, liver, large and small intestines, hand, arm, foot, and leg bones, veins and arteries. Using books, magazines, bulletin board displays, a child-size torso model, and their own bodies as references, the children sketched and cut out the required body

parts, arranged them on their outline, and glued them into place.

The students' biggest problem was how to determine the correct sizes and shapes for organs and bones. Books provided some help; several sources, for example, described a child's heart as about the size of his balled fist. The take-apart torso model also helped students grasp the relative sizes of internal structures.

At first, bones presented a real puzzle for the children. Questions from me helped one group to feel their own bones and joints. These students quickly saw that they could measure such distances as elbow to wrist and knee to ankle. One girl came to me, laid some paper bones along her arm, and said, "See, this is just the right length, and these two fit together like this." (She had good reason to be proud of her efforts; her first humerous had measured only ten centimeters.) Before long, pairs and small groups of children were working together, measuring, cutting, and comparing paper bones against real arms and legs.

Proper positioning of the organs and bones was another thought-provoking exercise. Each student met the challenge in his or her own way. Some children sketched, cut out, and glued in place one organ at a time. Others prepared several organs and glued them all at once. Still others organized all the body parts before reaching for the glue pot. When one boy placed his heart and lungs on top of his

ribs, another student pointed out the error, asking, "Why do you think you have ribs, anyway?" The first child thought a moment, laughed, then quickly changed things around.

The children offered each other constructive criticism. Often, their remarks were as humorous as they were helpful: "Sally, your brain is leaking out of your ears." Sally immediately trimmed her brain to fit inside the outline of her head. "That's really nice, George, but your lungs are in your armpits." George had carefully arranged the chest cavity organs, but a few inches too low. After comparing his layout with the take-apart torso, he made the necessary adjustments. "You'd better raise your intestines, Carol, or you're going to be kneeling on them." Carol had worn a dress the day her body had been traced. It took her some time to see where her intestines belonged.

Once the organs were positioned, the children added yarn to represent major veins and arteries-- red yarn for arteries, carrying oxygenated blood; blue for veins, carrying deoxygenated blood. At first, many students simply glued strips of yarn down the length of an arm or leg, without connecting the blood vessels to the heart. Once they realized that all veins and arteries must eventually connect with the heart, they were able to construct a more accurate system.

The final products were impressive. Although none of the

pictures represented human body structure perfectly, the students gained more realistic concepts of how they are "put together."

To Pick or Not to Pick-Outdoor Education (Hammerman, 1981, p. 63)

Value focus: Students will give careful thought before any plant is picked, and will be able to give acceptable reasons for their actions.

Implementation: Some plants can be picked with no danger of becoming scarce in an area and others cannot. Many believe that good conservation practice involves maintaining a variety of plants in an area. In order to decide whether to pick a plant or not, a number of questions can be considered. If the answer to a question is "yes", the plant may probably be picked for a particular reason. The student should decide how many "yeses" are needed in order to pick the plant. Instruct the students to go outdoors and select a plant and ask the questions. They are to decide whether to pick the plant at the end of the questioning process. (Caution: If there are rare or protected plants in the area and you do not want to risk them being picked, take the students to them first and go through the questions to illustrate why that plant should not be picked.)

Picking questions:

1. Are there more than 100 other plants or plant parts of the same kind in the area?
2. Can you learn something important from picking it that you couldn't learn by leaving it?
3. Can it be made into a useful product that will benefit people in some way?
4. Will the plant be as beautiful as it is now after it is picked?
5. Will the whole plant survive even if I just pick a part of it?
6. Will the area be improved if I pick this plant?
7. Will the plant be saved from destruction if I pick it?
8. Will the plant die soon and decay?
9. Is the plant safe for me to pick?
10. Is it alright to pick this plant even if the answers to all of the above questions were "yes"?
11. What will you do now? To pick or not to pick, that is the question.

When the group comes together again, the students' values may be assessed from their responses to the questions and from the discussion that follows.

Paper Making in the Classroom (Newmann, 1980, pp. 56-57)

Background information: Until 200 years ago, paper was made from rags. After a while, it got hard to find good rags. And paper made from dirty old rags was not very good to write on. (It was a bad time to try to make books!)

Then, one spring day in 1719, a French man named Reumer (RŌ-moor) took a walk in the woods. He went by an empty wasp's nest. He stopped and looked at it. Reumer saw that the nest was made of PAPER! How had a wasp made paper? There were no rags in the WOODS!

So Reumer began to watch the wasps. He saw them rip off little bits of wood. They seemed to eat the wood. The wasps flew back to where the nest was being made. There they would each spit out a little sheet of paper onto the nest. The bits of wood had been made into paper while they were inside the wasps!

Reumur saw that we could make paper from wood. We would just 1) Chop up trees into little bits. 2) Wet these little bits with water. 3) Chop them up again. 4) Add glue. 5) Roll the material out flat. 6) Let it dry.

Without paper there could not be houses, cars, planes, boats. All buildings are first planned on paper. It takes one ton of paper to plan a tall building! That walk in the woods 200 years ago made this a new life for all of us!

Directions: You will need fine meshed wire screen, a large flat aluminum frozen-food pan, a second aluminum pan

that can fit inside the first, a dishpan that will hold 10 quarts of water, 30 sheets of inexpensive facial tissue (not wet strength), two sheets of blotting paper the size of the first pan, liquid starch, measuring spoon, a blender or eggbeater, a sharp knife or tin snips, a rolling pin and an electric iron.

Trim the screen to fit inside the first pan. Cut most of the bottom out of the first pan, leaving only a one-half inch ledge that will support the screen. Cut out the entire bottom of the second pan, leaving only the sides. This is the mold for the paper.

Rip up the tissues and put them in the dishpan. Add one tablespoon instant starch mixed with 10 quarts of water. Use the blender or beater to beat until thoroughly mixed into pulp.

Put the screen in the bottom of the first pan. Set second pan of top of it. Hold the mold firmly on the screen. Dip pans and screen sideways into the pulp mixture. Clean off extra pulp around the edges of the mold. Disassemble pans and lift out the screen. Put the wet screen between the pieces of blotting paper. The paper will stick to the blotter. Remove the screen. Replace the blotter atop the paper. Use the rolling pin to press out extra water. Finally, use a warm iron to press the paper which is still between the two pieces of blotting paper. Trim the edges of the sheet is you like, and -- voila! Handmade paper!

Let each child make his/her own paper sheet(s). After drying, encourage children to choose a way each one would like to use his/her sheet(s): a special picture, a letter, etc.

Sense Walk (Schuncke, 1978, pp. 11-13)

The purpose of the sense walk is to recall and expand your sensory awareness as a preparation for working on sense awareness skills. Most of us have too little time for paying attention to and taking pleasure in touch or taste or sound.

Directions: You'll work on this exercise with a partner. You are going to be doing two sorts of exercises. One is a blindfold walk, in which you will focus on using all your senses except sight. Before you go on the blindfold walk, you'll have a chance to use your visual sense to gather information. Take writing paper and pencil. Go to a nearby park, public building or a community area. When you arrive, find a comfortable place to sit. Take out writing materials and do the following:

Step 1. Pick out three objects you can see from where you are sitting. Write down at least five, but use as many words as you can that describe (but do not name) those objects. Use the visual sense only. Later develop questions for discussion.

Step 2. Choose which person will be blindfolded (flip coins, draw straws, pull rank, or whatever method works) and

which one will lead first. Before placing the blindfold, let the person look around the area. At this point, you can either stay in the same location or lead the blindfolded person to a new location, but turn the person around so he or she is in a different relationship to the things around them. Then follow directions for Step 3.

Step 3. This exercise is very much like Step 1, except now the blindfolded person will be using all senses except sight. The blindfolded person will find three objects and do the following for each object:

a. Name the object (or make a good guess).

b. List any sense clues that are used for the identification and/or that seem distinctive (smell, taste, sound, touch).

Your partner will record these under the proper sense categories. Partners can discuss any questions about what to record and where. The main purpose is to collect information about each person's use of the senses in the blindfold situation. You might want to try to locate the same three objects you chose for the visual description, but it's not necessary.

Vitamin C Test (Wright, 1977, p. 576)

A dramatic, unexpected color change will occur in the presence of Vitamin C. This is used as part of a nutrition unit.

Materials: water, cornstarch, iodine, a variety of

foods with Vitamin C (orange juice, rose hips, green peppers, etc.), and without Vitamin C (potatoes, nuts, rice, etc.), small beakers or water glasses, Vitamin C tablets.

Procedure: Boil a half teaspoon of cornstarch in a little water. Add one or two drops of iodine and the mixture will turn a dark blue or black. Separate the mixture into several containers. Drop a small bit of food into each container. The foods with Vitamin C destroy the iodine starch complex. Following speculation about the common element in the foods which cleared up the solutions, test the solution with Vitamin C. Draw conclusions.

III-C Science Friendship Skills

A Bittersweet Tale of Classroom Potatoes (Flowers, 1982, pp. 44-45)

Do plants grow better if you talk to them? Do they really respond to kind words? These were the questions posed by one of my inquisitive third graders after seeing a TV program about the response of plants to kindness. The kids and I decided to experiment.

I selected eight sweet potatoes, all as close to the same size and weight as possible. (Health food stores may be a more reliable source of sweet potatoes than supermarkets, many of which carry sweet potatoes which have been

treated with something that inhibits their growth.) We put toothpicks in the sides of the potatoes and placed them in eight identical glass jars with the same amount of water in each. We marked the water lines to ensure that we would refill the jars with the same amount of water.

We then separated the potatoes into two groups of four each. One group was the love group; the other was the hate group. We put each group in a closet. The children told the hate group that horrible things would happen to them in the dark closet. They told the love group that no harm would come to them, that they were just going to sleep.

We didn't interact with the potatoes again until roots appeared, at which point we moved them to a long window ledge --the love group at one end and the hate group at the other end. Then we reviewed our plan. No one would touch the potatoes of either group; I alone would water them each morning, with no comment to the potatoes. The children could say whatever nasty things they wanted to the hate potatoes as long as they spent an equal amount of time saying loving things to the other group.

To assure both potato groups plenty of input, we spent our creative writing period each day writing odes to the love potatoes and odes to the hate potatoes, which were later recited aloud to the respective plant groups. One day a child would write an ode to the hate potatoes and

the next day write an ode to the love potatoes. The odes became the highlight of our day, with the children trying to outdo one another's nasty and loving comments.

Our experiment branched out into artwork, too, with the children drawing pictures of the hate potatoes at their ugliest and the love potatoes at their loveliest (lovely as a sweet potato can look.) They hung the pictures close to their respective groups and described them aloud to the potatoes. As with the odes, they had to give equal time to each group. The love/hate interchange continued with no visible response from either group.

An Unexpected Outgrowth: A week later one of the children came to me very upset. "Miss Flowers, there's gucky stuff all over one of the love potatoes."

I rushed to the love potatoes' side, and sure enough, one of the potatoes was white with a fuzzy moldy growth. I checked the hate potatoes. Little buds were beginning to pop out of the tops.

I couldn't believe it. I hadn't expected miracles from this experiment, but I hadn't expected it to backfire on me either. If what was happening was what appeared to be happening, I was teaching my class about the benefits of rudeness and hatred!

I didn't tell the other students what had happened. I wanted time to think first.

Over the next week my worst fears were confirmed. One

after another, the love potatoes began to rot visibly while the hate potatoes grew merrily along.

In an effort to come up with some kind of logical explanation for the devilish turnabout, I started watching the children more closely and listening very carefully to them talking to the plants. The first thing I noticed was that when they read their love odes to the potatoes, the words of warmth and affection came out cold and stilted. When they read their odes to the hate potatoes, their voices were animated and happy. I began to develop a hypothesis: It isn't what you say to a plant that matters; it's how you say it. Maybe plants, like animals, respond not to words but to vocal tone.

The hate potatoes, I speculated, had become the underdogs, and even though the children's words to them were hateful and negative, their tone of voice was positive and said, "Come on, make it!" When they said loving things to the love potatoes, however, their voices were void of emotion, apathetic. Perhaps the plants had responded to the emotions rather than to the words.

When I explained my theory to the class, there was not a word of dissent. I asked the children to write essays about what they thought had happened in the experiment. One of my students summed up the experiment neatly: "We fooled ourselves and we fooled Miss Flowers, but we sure couldn't fool those sweet potatoes."

Keys to the Kansas Environment (. . ., Kansas State Univ., 1980, p. 49)

Students collect items from home and environment.

Post-activity:

1. Bring these collections back to class, blindfold other classmates, and have them "feel" and guess what "feeling" you collected.
2. Ask each person to show what they found in each "feeling" category. Have them arrange these treasures on a work table and compare the different textures present.
3. Who found the most different kinds of feelings?
4. Who found the most unusual kinds?
5. Do some of these things feel sticky and rough?
6. Do some of these things seem smooth and sharp at the same time?

Natural objects which are available in many places are listed below. Note that many things have several "feelings". Have children make a chart.

Sharp	-----	thorns on wild roses, plums, hawthorns, locust, barb wire, broken glass
Round	-----	rose fruits, hack berries, cedar berries, galls in goldenrod stems, cross sections of most limbs and grasses
Sticky	-----	sap of trees, juice of berries and mashed fruit, mud
Rough	-----	rock, tree bark, burs, some weed stems, walnuts
Soft	-----	milkweed, cattail, cottonwood fluff, snow, spider web, caterpillar, fur, feathers
Hard	-----	nuts, rock, wood
Jagged	-----	leaf edges, some rock, cedar trees
Smooth	-----	milkweed leaves, cans, bottles, ice, apples

Wet ----- snow, mud, water, some sap, dew
Slimy----- frogs, salamanders, worms, some fruits
Spiny----- rose, blackberry and raspberry stems, locust trees, cactus, wild plum trees

Good luck on this adventure. It's hard telling what you will come up with.

Suggestions for Teaching Problem Solving - A Baker's Dozen (Krulik, Rudnick, 1981, pp. 37-41)

Regardless of what you decide to develop, here are some suggestions and examples to assist you in helping students become better problem solvers:

1. Create an atmosphere of success. Choose initial problems with care.

2. Encourage your students to solve problems; include areas of interest. Example: The weight of a $1 bill is one gram. A basketball player's salary is $1 million. If this is paid in $1 bills, can he carry it in a suitcase? Suppose he agreed to accept $20 bills? What other ways could his problem be solved?

3. Teach students how to read (and write) a problem.

4. Put your students into the problem. Example: How many times can you dribble a basketball in one minute? in five minutes? in ten minutes? What factors might affect your time? Get a partner, a ball, and a stopwatch.

5. Require your students to create their own problems. These originals may be tried out on classmates. Example: How much does a 100 pound lion eat in a week?

6. Have your students work together in pairs or

small groups. They help one another modify thinking, defend positions, express thoughts more clearly and precisely.

7. Encourage the use of freehand drawing. Example. Perspective - what would the other side of this structure look like?

8. Suggest alternatives when one approach has apparently yielded all possible information.

9. Raise creative, constructive questions. But don't rush.

10. Emphasize creativity of thought and imagination.

11. Use strategy games in your class.

12. Allow calculators (for some activities).

13. Don't try to teach new skills at the same time as problem solving.

A Skeleton Crew (Lehane, 1977, pp. 127-132)

Material: sticks, string, rules, reference books, bones and connectors.

Activity:

1. Students flex, bend, twist, identify joints and list the standard body part names (forearm, hip, thigh, etc.)

2. Students divide into partners and measure and record bone lengths.

3. Students collect sticks of correct lengths according to their charts-- may use small saws if supervised.

4. Students use tacks at ends of sticks or middle of

backbone. String is looped around tacks.

5. Students paint "bones" white. They may want to draw hands and feet. Construction encourages self-discovery and measurement improves accuracy.

6. Students use biology resources to find scientific names and aid in visualizing parts.

7. Students learn song "Dry Bones" and dance with skeleton.

8. Students can branch out in study of x-rays, anthropology.

The Environment (Stanley, 1979, p. 70)

1. Animal Habitats (Intermediate) Use this as an exploration activity. Take the class as a whole or in groups of ten, but work in groups of three to five to explore as many places (environments or habitats) as they can. Have students look for any signs of animals or actual animal life. They do not have to be identified, just found. Evidence of animal life could include sounds, partly eaten foods, droppings, homes, nests, feathers, holes in ground, logs or trees, spider webs, teethmarks, egg cases, tracks, etc.

When returning to classroom have students plot their findings on a map of the school site. This can lead to follow-up activities regarding the environmental factors such as light, moisture, temperature, wind, presence of plants, etc. that account for the presence or lack of

animals in each habitat.

2. School Yard Safari (Intermediate) This makes a good right brain follow-up to the previous activity. Ask students to take a "pretend" safari onto the school site. "Pretend" that buildings are mountains and great rocks. Look into the nooks and crannies for living things. Are the shrubs similar to the undergrowth of a jungle? Look for signs of life there as well.

Are there trees just like some in the jungle? Search them for wild things such as insect eggs, capsules, spider webs, leaves that have been nibbled. Go looking for live animals to "capture" beneath your hand lens.

3. Miniforest (Primary) Even an arm-circle of grass can provide a model of the environment of a forest. Take the children to a grassy spot on the school site and have everyone lie on the ground face down. Each should make an arm circle by stretching arms out in front of them on the ground. Some of the possible things to do are:

a. find at least five different plants inside arm circle,

b. see if they can find any tiny animals crawling through the grass,

c. what else can be seen? (Any dead leaves or twigs?)

d. spread the grass apart and describe what is seen.

Follow-up activity such as art work, drama or creative writing should emphasize the point that plants and animals live together in an environment.

III-D Science Citizen Skills

A Science Museum's Approach to Teaching Children about Energy (Bell and Connelly, 1978, pp.36-37)

Where do you get your energy? What kinds of activities do you do when you have a great amount of energy? What do plants do with their energy? How can we have some energy to use later?

When the students enter the classroom, a small Hero's Engine is steaming and spinning on the table before them. "Sterno" or "canned heat" is the heat source. As the water inside the engine boils, steam is produced and issues from three jets arranged in pin-wheel fashion on the sphere. (Hero was a scientist who lived in Alexandria, Egypt, and described this first-known steam engine in 120 B.C.) The Museum's engine is made from a copper toilet tank float suspended on a bearing, allowing it to rotate around a vertical axis. Small bent pieces of copper tubing soldered into holes on the equator of the float form the steam jets. If you make a Hero's engine be careful not to let it rotate too fast, lest boiling water sprays out of the jets.

The Hero's Engine is an immediate attention-getter

and conversation-starter. We use it to introduce studies of mechanical devices. "Can anyone figure out what is going on here? What is inside this thing? Can you think of anything else that spins when 'stuff' squirts out of it?" The familiar reaction of an inflated balloon when released helps to establish the reality of the jet propulsion that makes the engine spin.

The next gadget we look at is Max the Mechanical Muscle Man. Max is an anthropomorphic, pressure-driven waterwheel. Max obtains his energy from "eating" baking soda and vinegar, which releases carbon dioxide, providing the pressure to squirt water at a paddle wheel attached to his arms. Strings tied to the arms wind up and lift the weights from the floor.

We use Max to link humans and machines, and to introduce an analysis of an energy system. Where does the energy come from? What does it do? What changes take place along the way?

We focus attention next on a bean bag set on the floor. Does this thing have any energy? What kinds of behavior do we associate with things that are energetic? If we hoist the bean bag to the ceiling with a rope and pulley, does it have any more energy then? If the kids are not sure because it is hanging motionless, all the teacher has to do is step directly under the hanging bean bag and everyone can recognize its potential. When this stored energy

is released by dropping the bean bag on a lever device that pushes a toy truck, the energy is converted into a form with a more recognizable energetic behavior.

Equip a toy car with solar cells for power. The light activates the cells and the car moves. This toy introduces some speculation about solar cars and solar power. How could you go anywhere at night? Could you use stored energy? How could you store electric energy? What else is all around us and runs on sunlight energy? How do plants use energy? What happens to the energy in fruits and vegetables?

We examine stored energy in spring toys. Viewing their inside workings provides another opportunity for recognizing mechanical energy. Figuring out how something operates is a direct step in solving some of our energy problems.

Although the devices used in Get-Up-And-Go were specially designed for our Museum's program, the basic lessons and techniques can be replicated in any school. All types of toys and gadgets around home and school use, store, and transfer energy. Here are some suggestions:

1. Stand dominoes in a line, then push the first one over.

2. Line up marbles touching one another in the groove between two meter sticks. Roll another marble to strike the line and see what happens.

3. Use a mousetrap, a rubber-band-powered airplane, a flying saucer shooter, and other wind-up toys. Notice how they work.

4. Mix baking soda and vinegar in a liquid detergent bottle to pop a cork, inflate a balloon, and squirt gas to turn a pinwheel.

5. Build a Tinkertoy structure or use hardware-store pulleys to make a weight pull a toy car.

6. Make a nutcracker with a hanging weight and a pulley.

General questions asked at the right moments will help direct students' investigations and aid their understanding: What kinds of energy are involved? Where does the energy come from? What happens to it (transferred from one object to another, transformed to another kind, etc.)?

Exploring the energy of familiar objects can help students carry over into their everyday experience an awareness of energy and how it can be transferred, transformed, and stored. We suggest the following to start children thinking about the energy in their lives:

1. Trace the energy flow in toys and everyday devices; identify the different forms of energy and trace them back as far as you can.

2. As a class, list methods of storing energy. Where are these methods used? What kinds of energy do they store? How do they receive the energy?

3. Brainstorm together to list all the energy used by one person in a day. In what form is the energy and where does it come from?

4. Have the children draw "Rube Goldberg" devices, in which energy is transferred from object to object and transformed from form to form to create a chain of events.

Activities and discussions concerning energy in everyday life will raise questions about the world energy situation and can motivate student research. Some such questions are:

1. How limited is the supply of fossil fuels?

2. What are advantages and disadvantages of using solar, wind, and geothermal energy? Which ways of using these sources are most practical?

3. What are advantages and disadvantages of using nuclear energy to produce electric energy for people?

4. If you trace energy systems back far enough, you will find you always end up with the sun or nuclear energy on Earth. Find out more about nuclear energy. How does the sun produce energy?

The demonstrations and activities of Get-Up-And-Go begin with a child's intuitive feeling for energy to develop an understanding of energy systems he or she experiences. These experiences are a basis upon which to build an awareness of the world's energy-related problems and a start toward thinking about solutions.

Interdependent Living Things (Brunner, 1980, p. 11)

Here is an effective activity to help students visually identify the complex interdependent relationships which exist in our environment. The materials you need are readily available-- construction paper, crayons, scissors, and yarn or string.

Divide the class into groups of two or three. Each group will represent some aspect of the environment-- sun, trees, plants, water, fish, worms, air, cows, and people, for instance. Instruct the group to design pictures that illustrate the parts of the environment they represent. The pictures should be fairly large so that others can see them from a distance.

When all groups have finished their pictures, have students locate themselves in specific areas of the classroom. (This activity can be performed successfully outside since plenty of room is needed to situate all the groups.) Arrange the groups in a circle-like formation.

Pick a group to begin the activity, for example, the fish group. Ask the children in the fish group to identify all groups in the circle they need or depend upon for life. Ask why they are dependent on the groups they identify. Have one person called "web of life" run yarn from the fish group to all the groups that supply the fish group with life. each group will hold onto a section of the yarn as it is selected as "life giver". Do this with all the groups, ask-

ing, "Which groups do you need in order to live? Why?" Soon you will have a web of life connecting every group.

To dramatize the delicate environmental balance upon which the relationships hinge, appoint one pupil as the "spoiler". The spoiler is armed with scissors. The rest of the students are still in the web of life formation.

Suggest that the students pretend that the water group has become polluted by the spoiler and can no longer be life giver for any other group. Ask students to identify those groups that are dependent on the water group for life. Since the water group is polluted, instruct the spoiler to cut the webs-- string or yarn --that connect the water group to other groups. As the spoiler cuts the webs, students will be surprised to see how many groups become affected as a result of the loss of the water group. Repeat with other groups. Soon the relationships which once existed will become a tangled mass of lost life. Discuss results and implications with your students. Ask students to carefully examine the web of life in our environment. Which parts of the web are threatened in the world? Who is responsible for seeing that the spoiler not cut certain webs of life? Is the spoiler present in our communities? Who or what is the spoiler? What can we do to prevent the spoiler from ruining the relationships that exist in our local and world environments?

The Community as a Science Resource (Dawson, 1982, pp. 16-18)

Often when we say we can't teach science we mean we can't find the materials we need to teach science. In fact, however, an abundance of resources lies just beyond our doorstep-- in the people and businesses of our community.

Butcher Shops: Local butchers and slaughtering houses regularly discard usable biology specimens. Cow eyes may be obtained free or at nominal cost. Students can dissect them, find the lens, and identify other structures to achieve a better understanding of the human eye. Try dissecting cow hearts, or examining muscle, skin, organ, brain, or connective tissue. How do they compare to the same structures in humans? Ask the butcher for kidneys, brains, livers, knees, and other joints. Examining these structures firsthand extend children's understanding beyond textbook diagrams.

Most butchers also have shrimp, clams, crabs, lobsters, crayfish, or trout. Buy yourself a seafood dinner, but bring it to class first so students can study it. If you live near a fishery, try to obtain discards for classroom dissection and study.

Bakeries: Have students compare the shapes, sizes, colors, texture, and tastes of breads offered at the local bakery. How do whole wheat, oatmeal, cracked wheat, white,

pumpernickel, French, raisin, and Italian breads compare? What causes the differences? Bring yeast to class and explain its action.

Grocery stores: Foods represent an ideal way to involve children in science. Have them compare the color, size, shape, smell, feel and number of seeds in different kinds of apples. What happens to a piece of apple left out in the air? Why does rubbing it with a lemon slice slow color changes?

Cooking helps youngsters understand the nature of solutions and mixtures, the differences between fruits and vegetables, and the changes caused by heating, cooling and freezing. Make pizza in class; have students bring the ingredients. What is a mushroom? How does it grow? What are the differences between herbs and spices?

Dairies: Is there a local milk processing plant where students can see milk pasteurized and equipment cleaned? How is ice cream made? Yogurt? Cottage cheese? Perhaps the students can make one of these products in class.

Drugstores: Besides offering various chemicals for classroom experiments, the drugstore employs a valuable resource person: the pharmacist. Ask a pharmacist to speak to your class about the benefits and dangers of drugs. In what ways are drugs harmful? What is a generic drug? Why should prescription drugs be taken only with a doctor's approval? What chemicals are used in cosmetics and shampoos? How are walkers, canes, and other physical therapy

aids useful?

Music Stores: To enhance a unit on sound, visit a music store or invite students to bring their own instruments to class. How does each instrument produce its unique sound? What is the difference between pitch and tone? What makes one string sound different from another? How are a violin and a piano alike? How are they different? How does a flute compare to a drum? Students can make their own instruments and compare their sounds with the purchased instruments.

Health Professionals: Ask a dentist to lend or bring to your class X-rays, dentures, or models illustrating the structure of teeth, how to brush, and the consequences of neglect.

A doctor or nurse can demonstrate a sphygmomanometer to the class. With this instrument, students learn to take blood pressure and recognize the sounds representing systolic and diastolic pressure. Suggest a measurement of heart rate of children in different positions and after different activities. The dangers of high blood pressure and the importance of regular examinations and exercise may be emphasized in a unit on health.

Invite a dietitian to explain the main food groups and give examples of each, pointing out the importance of balanced meals and the danger of excess sweets. Why should we have vegetables? Why drink milk? What happens to people

who do not eat balanced meals? Show pictures of people with various deficiencies or discuss case studies. Give students a chance to ask the dietitian questions.

Construction sites: Local builders have different types of insulating and building materials for saving energy. Why must we conserve? How can each of us help? Some builders may donate wood, wire, pipe, etc. scraps for classroom projects. They may also explain to students how dishwashers, refrigerators, and hot water heaters work.

Outdoor School (Gilfillan and Burgess, 1978, p. 17)

1. Examine the soil near home or school as to texture, structure, and color. Get a soil text kit (County Extension) and test the soil. Find out what it means.

2. Examine a road cut near school to see different horizons of soil or rock.

3. Learn how to live trap small animals at the Outdoor School. Invite a speaker from the local animal control agency. How would you decide what to do with various "pest" animals? How do they affect human lifestyles?

4. Learn some common bird calls. Find out about animal and Indian communication.

5. Demonstrate transpiration of plants by placing a plastic bag over a plant. Leave some air holes to allow for gas to escape.

6. Demonstrate capillary action by placing a lump of sugar in a shallow dish with some food coloring on the bottom.

7. Demonstrate the principle of osmosis by placing a small herbaceous plant (its soil washed from the roots) into a solution of colored water.

8. Make a plaster cast of animal tracks. How can people use this information?

9. Observe various cloud formations and discover what they mean. How does weather affect our daily lives?

10. Study the effects of fire and fire prevention and its effects on human and animal communities.

11. Make an insect collection.

12. Visit a zoo, fish hatchery, greenhouse, etc.

13. Study the effect of earthworms, using a box, loam and worms (caught or sent for).

Outdoor Education: Census (Harris et al., 1977, p. 91)

Many of you may have heard of the "people" census that the government takes every 10 years. On the school yard there are many living things. There are also many things that man has put on the school site. Below is a check list. Take a walk around your school yard and check off all of the things you see. Decide if it is plant, animal or man made.

ant or ant hill_____	dandelion _____	flagpole _____
squirrel nest _____	clover _____	fence _____
wasp nests _____	wild strawberry _____	telephone pole _____
holes in ground made by insects_____	sour grass_____	sidewalk_____

bird nest _____	moss _____	parking lot _____
bird _____	shrub_____	play area _____
animal print_____	vine _____	trash cans _____
half eaten leaf _____	a yellow weed_____	fire plug _____
spider _____	lichen_____	stop signs _____
earthworm _____	gall _____	bicycle rack _____
grasshopper_____	evergreen _____	gutter _____
bee _____		light meter _____
insect on bark of tree _____	broadleaf tree_____	transformer _____
pill bug (sowbug) _____	mushroom____	cement area (blacktop) _____
other _____	fruit tree _____	other _____
	other _____	

Which animal do you think is the most numerous on this site? Which plant has the greatest number? Why does this plant grow so well on the school site?

Which of the man-made items are pretty? Which are ugly? Could the ugly ones be made better looking? How?

Experimenting with Solar Collection and Radiation Cooling (Harrison, 1980, p. 29)

In view of the current interest in alternative energy sources and the developments now occurring in the harnessing of solar energy, it seems appropriate to consider some simple experiments involving solar radiation collection.

Two such experiments using easily assembled equipment

are described here. The experiments demonstrate the relative absorption properties of black, green and white latex paint surfaces towards incident solar radiation at different solar zenith angles. Interpretation of observations requires some understanding of the solar spectrum, emission and absorption of electromagnetic radiation, and an appreciation of energy conservation.

In the first experiment, three one-gallon jugs each filled with methyl alcohol were coated with black, green and white latex paint respectively. If the experiment had been performed in a warmer climate than that encountered here, the methyl alcohol could have been replaced with water.

The jugs served as solar collectors, their relative collection efficiencies being monitored by comparing the temperature of each with that of ambient air. The latter was measured with a mercury-in-glass thermometer placed inside a white cubical box (12"x12"x12"), ventilated to the outside air and constructed so that direct solar radiation could not fall on the thermometer bulb. The temperature of each solar collector was also measured with mercury-in-glass thermometers, all having scales reading to 0.1°C.

In the second experiment the three jugs were replaced by three flat aluminum plate collectors coated with the same black, green, and white latex paint as used with the three glass jugs. Each plate formed the retaining face of an insulated dead air space. Again, mercury-in-glass ther-

mometers were used to monitor the temperature of each air pocket concurrently with the ambient temperature. Each plate was recessed into an insulated retaining box. A thin sheet of transparent polyethylene placed approximately one inch in front of each plate provided a stagnant air layer between the collector surface and ambient air, the intended purpose of this being to cut down on heat loss by convection to the atmosphere.

Both sets of solar collectors, along with the ambient air vented box, were placed in an area open to the sky through most of October and November 1979. The equipment was positioned such that at no time during the day was any part of it in shadow. Temperature readings of black, green, and white solar collectors and of ambient air were taken at roughly half-hour intervals along with estimates of sky (cloud cover) and/or at early morning, at noon and at the end of the school day when equipment was brought inside. Temperatures were taken again on the following day before taking the experiments outside.

Solar energy into heat energy: The conversion of solar electromagnetic energy into some other useful form of energy in a solar collector is necessary if the latter is to operate with a positive efficiency. In the systems used here, the conversion takes place into heat energy which is stored in the bulk fluid of the collector. Under conditions of thermal equilibrium between the mass of each collector

fluid and its surroundings, the rates of heat gained and heat lost must be equal. The rate at which heat is gained depends on the absorptance of the collector surface, while the rate at which heat is lost depends primarily on the temperature difference of collector fluid and surroundings. This was then followed with discussion of application for homes and businesses. The principle is simple, the social implications are seen as important.

IV-A Social Studies Learner Skills

Acting Out . (Benninga and Crum, 1982, p. 146)

The use of pantomime activities (communication without words and dramatic expression through body movements) allows children to try on the specific behaviors of people and objects in a non-threatening way. A small box passed around a circle of children can become for one child a small fuzzy kitten and for another a rubber ball. Any number of such games, designed to let children freely pretend and make imaginary substitutions, are appropriate for the later process of decentration and role taking. Encourage facial expression and awareness of posturing.

Facial expression ("You have just received a new puppy", "You meet a Martian on the street", "You just lost your mother in a large department store"), body movements ("Walk down the street where you live", "Walk down a strange street at night", "Walk down a busy street during the Christmas rush"), and our senses ("You are eating a tough piece of meat", "You hear a loud crack of thunder", "You just touched a hot stove"); all change as we encounter new situations. These simple pantomimes which ask the children to take another perspective can later be broadened to include whole scenes as well ("You are a postman delivering the mail", "You are responsible for getting your younger sister dressed, fed and ready for school").

Children's experience with pantomime facilitates the transition to actual story dramatization. The actual dramatization or acting out of a story or situation allows development of sequencing, perception of socially appropriate responses, and awareness of non-verbal communication while pretending in a safe environment.

Using Catalogs to Develop Inquiry Skills (Horak and Horak, 1981, p. 30)

The catalogs published by most large department stores can be used effectively with students to conduct meaningful investigations and practice inquiry skills. Some catalogs (Sears, Montgomery Ward, Spiegel) offer more opportunities for investigations than others, but almost any store's catalog can be used.

A variety of activities are possible which help build economic concepts and implications. Students may pursue teacher-directed investigations or may devise problems of their own to solve. The questions and activities described here are not designed for one specific grade level, but instead are useful for any classroom and can serve as a springboard for other scientific investigations.

Comparisons: Begin by asking students to compare store catalogs and see what items appear in the last few pages. Discuss the findings. Can students infer whether males or females use the catalog more? Is it true for all types of catalogs? Along the same line, ask the students to count the number of pages in the catalog devoted to men's

and women's clothing. How do the numbers compare? Are there more pages of one type? Students can practice their math skills by averaging the number of pages for different items such as ladies' clothes, men's clothes, or women's and men's shoes. How do the averages compare?

Contents: Ask the students to chart the number of catalog pages devoted to different products-- sporting goods, household items, toys. Discuss whether people appear to be spending more or less money on these items than in other years.

Question students concerning the cost of the items advertised. Have them find several consecutive pages that contain sporting goods, major appliances, clothing, and jewelry. Ask them to compute the total cost of the merchandise on these pages. How do the costs compare among types of items? What is the most expensive item? What is the average cost per page of advertised merchandise? Using the average cost of merchandise per page, students can estimate the total cost of one type of merchandise in the catalog. This is done by multiplying the cost per page times the number of pages. How accurate is the estimate? Ask students to calculate the total cost of merchandise in the catalog. Students should come up with many approaches to solving this problem. Have students construct bar graphs displaying their findings.

Questions can be asked concerning the color of clothing

and the materials from which clothing is made. Ask students to pick five consecutive pages from either the men's or women's clothing sections and determine the range of colors available. Is there a noticeable difference in colors between a fall catalog and a summer catalog? Why? Students may repeat this activity, only this time checking the materials - silk, wool, cotton, and polyester. What are the differences in materials displayed for each season? Why is there a difference?

Index and Order Forms: The catalog's index and directions for ordering are also useful. Ask students to review the index. Is it alphabetized? Are some things listed in more than one place? Where would you look for electronic games, for example? From the order forms students can learn how catalog items are systematically numbered. Discuss how it is possible for the store to determine quickly what articles have been ordered. Is it possible to guess at the maximum number of articles most people order? Ask students to consider how sizes of clothing and shoes are determined. What measurements are used for clothing? For shoes? Have metric measurements affected the clothing industry? The appliance industry?

Pricing Information: Other areas of research could deal with comparing the prices of the same article over a period of years. Which items experienced the greatest price increase-- clothing, tires, jewelry, refrigerators?

Have goods made from petroleum products (for example, tires) increased in price more rapidly than other goods? Has the price of gold jewelry been affected? How much has the cost of a pair of men's shoes increased between 1978 and 1981? How does this compare with the officially reported rate of inflation? Does this indicate that inflation is getting better or worse? Are there any items (for example, electronic calculators) for which prices are going down instead of up?

Other questions can be asked concerning price comparisons. Ask students to find an identical item, such as a camera or toy, in two or more catalogs. Then compare the prices and see if one company offers consistently lower prices. Why might this happen? As a final comparison ask students to notice how catalog prices compare with prices in an actual retail store. Whose are lower? Why? What does this tell us about the cost of display space for major department stores?

These simple queries can lead to more complex data collecting and graphing. All that is needed is a set of old catalogs, a classroom of interested students, and a number of thought-provoking questions. Properly presented, catalogs can be a starting place for many educational experiences.

Magazine Mix (Discovery Techniques) (Mamchak, 1977, p. 42)

The students are broken up into workable groups, and

each child is given a magazine, (each group in the event there are not enough for all). Every time the children come across a picture of a man or woman or both doing something, wearing a uniform, playing sports, etc., it is to be cut out. The picture is then taken to the front of the room and placed in one of several shoe boxes which have been labeled Sports, Jobs, Service, etc. This activity is continued until each box contains at least ten pictures. The teacher then stops the activity and regroups the class. Each new group is given one of the boxes plus three envelopes, one marked Male, one Female, and one Both. Students are now asked to decide where each picture belongs and place it there. For instance, if only women can do a particular thing then the picture belongs in that envelope; if only men, then in that envelope; if both, then there. The activity is given about ten minutes. Then one person is chosen from each group to defend the group's choices for that box. The rest of the class agrees or disagrees and discussion, guided by the teacher, follows. Strengthening Map Skills Through Orienteering (Van Cleaf, 1981, pp. 462-463)

Conceptual learning is enhanced with hands-on learning experiences. Concepts pertaining to map reading are no different. Elementary school children typically learn map skills through paper-pencil activities. At best, experiences are limited.

Orienteering is a sport that can actively involve children as they develop map-reading skills and concepts. This sport involves land navigation. Participants use maps and compasses as they "run" a predetermined course. The objective is to use a map and directions to locate specific check points as a person negotiates a course. While orienteering may be competitive or undertaken for the personal enjoyment derived from an activity that takes place in an outdoor setting, teachers can adapt the principles for instructional purposes. As children "run" an adapted orienteering course, they become actively involved in a task that reinforces skills and concepts pertaining to map reading.

An orienteering course consists of a starting point, a series of check points, and a finishing point. The course is laid out on the ground, and a corresponding outline is superimposed on the map. The check points are numbered sequentially, and each check point has a marker. The marker contains the number of the check point and a word, letter, or some other notation. As children arrive at each check point, they are required to record the letter, number, or other notation as evidence that they were at the correct location.

An orienteering course can be established either in the classroom, on the playground, or at a nearby park. A map of the area must be constructed in such a way that

children have no difficulty reading it. Map symbols (Pictures) should approximate their referents as closely as possible. A legend should be constructed to reinforce the relationship between the symbols and the objects they represent.

The map should also include a space in the corner on which students can record the word, letter, or other notation found on each check-point marker. To make the task more interesting, the letters placed on each check point are part of the final message. As the children complete the course in the proper sequence, a message will be spelled. This eases the teacher's task of evaluating the students' efforts and adds an additional challenge.

Students are now ready to "run" the course. They should be allowed to work either individually or in pairs. Do not allow all the students to begin at the same time. You will want to allow several minutes between groups so that they do not simply follow one another. In order to manage a staggered starting time, several options are available. While some students are running the course, the remaining students can be engaged in a related activity. Students may also be dismissed from class work. However, this will require a person to supervise the children while on the course. A third possibility would require the teacher to establish several courses in the same area. The same beginning and end points can be used, but the students

would proceed to different points.

A more difficult activity requires children to run a course without the course superimposed on the map. Students are provided with maps and an instruction sheet. The instruction sheet lists the directions and distances from point to point. Students then use the given directions to locate the check points. This activity may be extended by providing children with a compass and compass directions in degrees (Point 1: 345° - 35m; Point 2: 270° - 60m).

As students navigate the course, they will develop and reinforce map concrete ways, such as through orienteering, they will begin to abstract map properties and relationships. These abilities will then enhance acquisition of higher order map skills. Concrete experiences with familiar places will ease the transition to using maps of more distant environments.

Multicultural Early Childhood Education (Youngblood, 1979, p. 41)

What is effective in childhood multicultural education? In many instances the specifics of just what is or is not effective under what conditions must await additional research. The following basic procedures, however, appear to offer considerable hope for effectiveness in concept development when used together in a thoughtfully planned

multicultural program for a group of young children.

1. Custom design the multicultural education program to meet the special multicultural education needs of the particular group of young children it will serve. The specifics of the multicultural education needs of a group of young black children in the inner city are obviously different from those of a group of upper class white children in an "exclusive" suburban area. The inner city black group probably will need special emphasis on such areas as learning about and developing pride in the Black American heritage and opportunities for positive interaction not only with other ethnic groups of the inner city, but also with the assimilated white middle class ethnic groups of the suburbs. This can also include factual films, speakers, historic biographies, even novels.

2. Involve the parents as partners in all aspects of the program from planning to implementation and evaluation. Multicultural education is an example of a childhood education concern that must have the understanding, support, and active participation of the home if it is to be fully achieved. Much of the multicultural education of the young child does and should take place in the home and can be shared. Plan a tasting party with parents bringing special cultural dishes. Encourage the children to taste everything.

3. Provide all young children with many opportunities to learn about, to enjoy, and to share in a rich diversity of ethnic heritages. For young children seeking a strong sense of their own ethnic identities, provide many continuing opportunities for them to learn about, to enjoy, and to develop pride in their personal heritage. Set up displays, with help of parents. This might include a fiesta, a Japanese girl or boy day.

4. Learning experiences about ethnic heritages should always be as enjoyable, fascinating, exciting, self-enhancing and actively involving as possible to the young child. Multicultural education in this context has its greatest hope of success. Always communicate to young children the fact of great individual differences within a particular ethnic group.

5. Provide many opportunities for parents, other concerned adults, and young people to share with young children an enchanting diversity of ethnic heritages. The sharing can include such things as folk songs and dances, folk tales, a language or a dialect, ethnic food, and ethnic arts and crafts. Encourage parents to teach these to the class, probably one at a time so as to give them the entire class's attention.

IV-B Social Studies Being Self Skills

Black Roots: Using Genealogy in the Classroom (Bennett, 1980, pp. 68-70)

The quality and quantity of student learning is proportionate to the student's development of a positive self-concept. Self-concept refers to the attitudes and feelings a person has towards ones' self. It influences behavior, responses to environmental stimuli, adjustment, mental health, well-being, personal happiness, and interpersonal relationships. Teachers can be effective self-concept enhancers for black adolescents. This can be approached in various ways. One approach has been suggested by Roth, Golin, Davis, Zuckerman, and Harrison, and Georgeoff. They found the teaching of ethnically relevant material to be an effective self-concept enhancer in black adolescents. This article examines one strategy for using ethnic material in the classroom to stimulate black adolescents to learn and use their intellectual potential.

Ever since the publication of Alex Haley's Roots, black Americans have shared his travel to trace his ancestors. Why? Our ancestors have shaped us --our values and customs, our hopes and aspirations. It is correct to say that Roots produced a tremendous awakening on the part of black America to their past. Specifically: this book made history personal; linked a large segment of the population with many facts; and stressed the durability of the black slave.

Haley's search for his own identity emphasized the valuable source which oral history can provide for learning about the American past. The implication is that genealogy can be used effectively to teach:

1. cognitive and affective skills
2. local problems and issues
3. family developments affected by historical events
4. social science concepts

Black genealogy is the documented history of a person or family whose linkage between generations is "supported" by the best available evidence. In many ways black genealogy parallels the genealogies of other ethnic groups in the United States. Yet, the method used to establish linkage between a family of African ancestry is different from white genealogy; specifically, the methodology used as well as the sources consulted.

The pedigree chart serves the purpose of recording graphically, linkages between generations which have been established. It is a good place to begin. The purpose of this chart is to identify one's paternal and maternal ancestors, and to indicate what one knows about their dates (birth, death, and burial and their spouses).

Additional charts helpful to document proof of relationship include: a) correspondence chart of inquiries sent and received; b) family data chart to provide supplementary data about one's paternal and maternal ancestors;

c) research register chart to record documented information regarding wills, marriages, births and deaths, church affiliations, military, deed and related genealogical records. Summarily, to conduct genealogical research requires extensive record keeping. This task becomes critical in order to document the true relationship which exists between a person and family.

Oral history involves the gathering and interpretation of data through interviews. The interviewer's major purpose is to obtain information which will shed light upon one's family. Specific concerns to focus upon in the black interview include, but are not limited to, sources related to the black experience: for example, church affiliation; slave ownership; employment records; involvement with the law, if any; linkage with persons of other races; source of subject's name; and the status (slave or free) of the subject's ancestors. The oral interview, therefore, requires the employment of communication and social skills by the interviewer. The training method thus becomes important.

There are several strategies that the interviewer should be familiar with in order to effectively gather information, for example: What will be done with the information? How can objectivity be maintained? What active listening skills are necessary to elicit information? What note taking skills are needed to record information? How

will skeptical doubting offset the subjective interviewee? The following role-playing exercise can be used effectively in the classroom to teach correct interviewing techniques:

1. Were there any unusual circumstances about your birth?
2. List any important events that took place (between your parents during early childhood).
3. Briefly describe your parents and their parents.
4. Did your parents move from their birthplace?
5. What prompted this move?
6. Did you move from your birthplace?
7. Why?
8. How old were you?
9. What person can describe your early childhood?
10. Where did you go to school?
11. Are there any landmarks (historical or interesting buildings or sites) present in the city which you remember when you were growing up?

It becomes clear that the many problems encountered in the role-playing exercise will help students develop thoughtful search skills. The role-playing exercise focuses upon group participation skills, gathering and evaluating data, problem identification and solution, and the communication skills of reading, writing, speaking, and listening.

Genealogy is more than collecting names of one's ances-

tors. From it the students may obtain information which might help to document family history as well as learn a great deal about the history of the United States. Sources of black genealogical records help the student genealogist to examine numerous written sources to assist in locating the pieces of one's past. The following records can help in this search:

1. courthouse records
2. census records
3. public vital statistics
4. church records
5. cemetery records
6. federal military records
7. Freedman's Bureau records
8. miscellaneous records (black insurance companies, businesses, associations, organizations, etc.)

In every community there are more resources than any dedicated teacher can tap.

One's past is important in the development of self-concept. A desire to achieve plays an important role in academic performance. Many researchers have shown that black youth have difficulty achieving academically on a level with their high aspirations. Where does the social studies teacher fit into this scheme of things? Research indicates that ethnic studies and other culturally relevant programs have the potential for enhancing self-con-

cept of black children and adolescents. This self-concept enhancement is facilitated by treatments focusing directly on self-concept related material. St. John found that teacher attitudes and classroom techniques may lessen or intensify a fear of failure with the black student. Using genealogy in the classroom is one strategy for stimulating black children and adolescents to reach their intellectual potential.

Clan Symbol (Clute, 1979, p. 25)

Materials: two inch square pieces of felt, several beads of desired color, thread, needle, two inch dquare piece of leather-like material, leather thong.

Method: Provide each student with above materials. Direct the student to draw a clan symbol as studied on the felt. With the threaded needle, the student will bead the outline of the animal. It may then be sewn to the thong or string to wear or hang.

Variations: For the turtle symbol, a large one inch button (the kind with no button holes, but the thread hole is on the underside) might be used for the body. The beading would be for the outline and for the head and legs.

Stand Up and Be Counted (Scalzitti, 1980, pp. 12-13)

Getting to know you, getting to know all about you, may be a fitting expression in 1980. Once again, the United States Government is undertaking the monumental task of counting and assessing information about our society and

its people. The Bureau of the Census is in the process of gathering facts on population, housing, agriculture, industry, transportation, health, education, income, prices and much more, as it continues the tradition begun in 1790.

Certainly, being observant mathematical educators, we should recognize this census taking as an opportune time to enrich the understanding of the practical use of mathematics in real-life situations. The census is a beautiful application of many statistical concepts, such as conducting surveys, tabulating data, finding means and medians, and interpreting data. Furthermore, general mathematical and arithmetic skills are also used, for there is ample need for basic computations and percentage work as well.

An effective teaching and learning tool in this area would be some hands-on experience. How about a mini-census of your school! Consider the following plan, which was designed for a middle school, grades five through eight.

As with any census, detailed planning is in order. One must decide what topics to cover and questions to ask. Agreement on the method of collecting information needs to be made. And finally, the heart of the matter, the mathematics needs to be done.

For this particular project, the eighth grade mathematics classes could be the coordinators and sponsors for the census. All classes (grades 5 through 8) could compose the sampling population.

First, a data sheet needs to be constructed to collect the agreed-upon information. Sheets would be sent to and completed in each homeroom, collected, and sent back to the coordinating group.

When the data are all collected, the eighth grade can compile the statistics in chart form and, if they wish, graph the results as well. Certain information, such as average prices of goods which the group may agree to include in the census, would be the responsibility of the coordinators to secure through research. Under the guidance of the teacher, average and median figures for any of the subsections could also be computed. Finally, the results should be published and given to the school body with appropriate explanation where necessary.

From the experience of collecting and reporting data, the students will gain first-hand knowledge of the working and value of a census. Broader knowledge can be achieved if other subject areas, such as social studies and language arts, are also included in the project. A school project requires schoolwide cooperation.

It is important for students to learn that you not only count with mathematics, but also you can count on it. You count on it to help you get to know and understand things better. Join the census taking by letting your class stand up and be counted.

The next two sheets are examples of data information and the completed report form.

Data Information Sheet

Grade_____ Male_____ Female_____ How many brothers or sisters?_____

Check the type of home you live in:

Single family, detached_____
Single family, attached_____
Two-family dwelling _____
Multi-family dwelling _____

How is your home heated?

oil_____
gas_____
solar_____
other_____

Check any of the following illnesses you have had:

Chicken pox _____
Mumps _____
Tonsillitis _____
Measles _____
Appendicitis_____

Do you wear braces on your teeth?_____ Do you wear glasses?_____

Do you have a job, such as babysitting, for which you get paid?_____ What kind of job?_____

How many of the following things does your family have? Use numbers in the blanks below.

telephones_____
televisions_____
radios _____
cars _____
calculators_____
stereos _____

Do you get a newspaper at home?_____
daily _____
Sunday_____

Do you have a cable television?_____

Do you take a bus to school?

Census Report Form

POPULATION
BY AGE
under 9 _____
9-11 _____
11-12 _____
12-13 _____
over 13 _____
BY GRADE
fifth _____
sixth _____
seventh _____
eighth _____
SCHOOL ENROLLMENT
Male _____
Female _____

EDUCATION

EMPLOYMENT
babysit _____
deliver
newspapers ___
Yardwork _____
other _____

PRICES
white bread, per pound
hamburger, per pound
milk, per quart

COMMUNICATION AND
TRANSPORTATION
number per family
telephones _____
televisions _____
radios _____
cars _____
calculators _____
stereos _____
cable t.v. _____
daily paper _____
Sunday paper _____

Number of students who
ride bus to school _____

FAMILIES
Only child _____
One sibling _____
Two siblings _____
3 siblings _____
4 siblings _____
5 or more ____

HEALTH
ILLNESSES
chicken pox _____
measles _____
tonsillitis _____
appendicitis _____
NUMBER WHO WEAR
braces on teeth _____
glasses _____

ENERGY
HOMES HEATED BY
oil _____
gas _____
solar _____
other _____

HOUSING
Single family, detached _____
Single family, attached _____
Two-family dwelling _____
Multi-family dwelling _____

--

Imaginary Vacations (Swaggerty, 1981, p.272)

A problem shared by many students in my geography classes has been lack of interest. Upon investigation, I learned that this stemmed in part from the fact that they could not perceive the relevancy of geography. Places and people outside the immediate area seemed of no concern because the pupils could not see how faraway locations and peoples could possibly influence their lives.

As a first step in showing my students that geography is indeed a relevant study that does have importance in our lives and can be an enjoyable learning experience, I came up with the following activity. It consists of three parts.

Students individually planned three imaginary vacations to destinations of their own choosing. The only stipulation was that the first vacation was to be taken within their own state, the second vacation was to be anywhere within the United States (with the exception of their home state), and the third vacation was to be anywhere in the world outside of the United States.

Each vacation was to last two weeks and would begin from the students' doorsteps. To help plan their vacations, students used reference materials, textbooks, travel brochures (easily obtained from a travel agency), newspapers, maps, and atlases. Students planned their own itineraries and kept logs of places they thought would be of interest.

The following items were to be included:

1. Mode of transportation.
2. General description of areas to be visited.
3. Types of attractions or activities that the areas offer.
4. Time to be spent at each location.
5. Major industries of the areas to be visited.
6. General description of the people of the areas to be visited, such as their customs, jobs, etc.

These items were not meant to be all-inclusive, but rather served as guidelines for the students. Items could be deleted or added.

The activity, which can be divided into three distinct units-- state, country, and world, proved to be highly motivational because students chose the places they would like to visit or to investigate. When the time came for students to share their vacations with other members of the class, they seemed genuinely enthused and they eagerly shared their findings with the class as a whole. It was a good exercise in decision-making; and students made use of map skills, library skills, and a variety of other basic skills. Best of all, however, students began to show an interest in areas of the world outside their immediate locale.

Social Studies, Thought and Language (Tovey and Weible, 1979, pp.167-169)

Children are excited and motivated by actual experiential education. These primary activities give children an opportunity to relive various chores and social activities of pioneers. Children actually perform such chores as making candles and bread, churning butter, quilting, and sawing wood, square dancing and husking bees. Even though these experiences are novel and entertaining, their writings and discussions indicate that they would not want to live as the pioneers did. Their responses repeatedly indicate the degree to which they value the conveniences of our life-style.

1. Candles: wax/paraffin, wick, various waxed cardboard containers. Heat carefully with teacher supervision, pour wax into molds. Crayons may be melted in for color. When hard, peel off cardboard.

2. Churning butter: Use old-fashioned churn with plunger if available, paddle-jar if available, or glass jars with lids that seal tightly. Cream is put into container. Seal lid. Use plunger, turn paddle, or shake jar until yellow lumps of butter form. Separate whey from butter. Wash. Eat or refrigerate.

3. Quilting: Students draw and color a repeating geometric design. Using cloth scraps, they sew all edges together to create the picture they drew. Use single cloth

backing; measure and stuff. At regular intervals make yarn tacks that knot in front.

IV-C Social Studies Friendship Skills

The Making of a Cradleboard (Clute, 1979, p. 9)

Background Information: The parents of the new infant usually make the cradleboard. The base of the cradleboard is made from a sturdy white pine material because it provides the child with the support needed to help the child develop good posture.

The tree is cut into the lengths needed which is approximately one foot wide by two and a half feet long. The bark is cut away from the board and then the surface of the board, on both sides is repeatedly rubbed until all the rough spots disappear and the grain of the wood becomes clearer.

The board is then cut into a conical shape, allowing a wider portion for the infant's shoulder and head, and tapering to about eight inches wide at the foot rest. Roughly measuring about five inches from the very top of the board and marking approximately one half inch from both ends, two slots of one half inch wide and one and a half inches long are cut into the base. These two slots allow for inserting the ends of the rim into position. This rim is made from a soft wood material because it is necessary to bend the rim into a semi-hoop shape, before

inserting the ends of the rim into position, before inserting the ends into the slots cut into the base. After the completion of the base and inserting the rim, two small wooden pegs are placed through the width of the rim at both ends and attached on the back side of the base. This reinforces the rim and adds the protection the infant needs in the event the cradleboard falls over. The last part to be attached is the foot rest; this is approximately one half inch by one inch by four inches long. The foot rest can be made from the same material as the base board. Small holes will then be drilled along both sides of the base board up to the rim; each hole should be about three inches apart. Rawhide lacings will be interweaved through these holes to help secure the infant onto the board. Now the board may be decorated and trimmed; this is usually left up to the women to do as they desire.

Procedure: Show cradleboard and explain the materials used. Using a doll, show how baby would be put into cradleboard. Pass around so students can have a close view. Materials for each child: posterboard, two sticks, felt cloth, beads, needle, thread, yarn, scissors, glue. Sticks form side-frame, with posterboard in between. Cut head and foot boards and attach at right angles in slots at top and bottom of back. Punch holes along each side for lacing. Blanket is decorated. Yarn or rawhide laces are used to lace criss-cross cover to board. Additional decorations, feathers, fringe, etc. may be added.

Touching, Living and Growing (Fisher, 1981, pp. 53,67,82 and 85)

1. If you live in the Frontier area, invite elderly people in your area that remember pioneering, or have heard stories of pioneering from their parents. Record and listen to what they have to say. Make a collection of these stories; publish them.

2. Ask children to bring to class pictures taken when they were babies and when they first started to school. Display the pictures with the title "We Grow and Change".

3. Over a period of several days, have children construct a personal time line of important happenings in their life. Make drawings of five to seven important events. Construct in sequence on sheets of 9 x 36" paper.

4. Read and discuss air transportation. List occupations dealing with air transportation (traffic controller, pilot, flight attendant, flight engineer, airline dispatcher, ticket salesperson). Write to airlines (addresses may be obtained from newspaper) for information. Construct a model airport and include the people performing various jobs. Allow small groups to create situations and dramatize them for the class (e.g., My grandmother is flying in to visit at 8:45, but she doesn't know where to meet us).

5. Invite a commercial truck driver to speak to your class. Arrange for students to examine and sit in the vehicle.

Outdoor School Follow-up (Gilfillan and Burgess, 1978, p. 31)

One of the most vital jobs for the teacher will be conducting the follow-up activities after any Outdoor School experience. It is in this phase of instruction that the learning activities of the resident program may be instilled in the mind of the student.

The following list of classroom and individual activities is by no means a complete list. You will want to add many more of your own ideas to these follow-up activities.

As a class unit, plan a parent's night or school assembly to share the experiences of the Outdoor School.

1. Posters about experiences
2. Written reports
3. Displays of soil, water, plants, animals, ecology. conservation
4. Oral reports (The Typical Day)
5. Campfire songs and skits
6. Slides and pictures
7. Write letters to various staff members.
8. Make a map of the Outdoor School site drawn to scale.
9. Compile a photo album of experiences at the Outdoor School.
10. Write an account of your week at Outdoor School.
11. Write articles for the school newspaper.

12. Compose poetry from inspiration gained in the out-of-doors.

13. Plan ways in which the school grounds might be made to look more attractive.

14. Plan a school garden.

15. Plan a campaign for keeping school grounds cleaned up.

16. Take a field trip to a park or along a nature trail witha class from one of the primary grades. Each sixth grader escorts one of the primary youngsters and points out some of the various things learned at the Outdoor School in the different resource areas.

Nursing Home Visit (Newmann, 1980, p. 126)

You might consider taking your class to visit a nursing home during the holiday season. If you do, here are a few suggestions:

1. First you go and check out the facility. Is it really an appropriate place for a class visit? Ask the administrators what small gifts or food your class might bring. Discuss their singing carols or giving a puppet show or a short play. If your class does visit, ask if you might meet the patients in the reception room.

2. Check with your principal and get his/her okay.

3. Then present the idea to the class and get their thoughts. Discuss aging and family structure, and how

the elderly can contribute.

4. Notify the parents via a mimeo and get their okay. Children should understand in advance the kinds of elderly people they'll be meeting (e.g.,bedridden, blind, deaf, in wheel chairs, sedated).

5. Help the kids write a follow-up letter to the nursing home patients and staff.

All American Popcorn (. . ., Wichita Public Schools, 1978, pp.1-3)

While the corn is popping, students will describe sight, sound, and smell. If making popcorn balls, student groups contribute some of their popcorn to make a large class recipe of balls. The results of moisture being heated will be observed. The history of popcorn expands American Indian studies. Field research on homemade vs. purchased will provide experiences in consumer education.

Activity Procedures:

1. Explore the history, science, and nutrition of popcorn.

2. Set up a popcorn learning center in the classroom. Small student groups rotate in the center to pop corn. This provides experiences in measuring and following directions.

   a. Use a popcorn popper and a Student Activity Sheet. (A saucepan can be used for intermediate grades.)

   b. Each class uses 1 liter popcorn if a class-

room recipe is to be made. At least six groups will be needed.

c. Stress safety with hot pans and poppers.

d. Talk about what they saw, heard and smelled.

3. The teacher, with student aids, measures and cooks syrup for popcorn balls. The teacher mixes the syrup into the popcorn. Each student shapes a medium-size ball. Caution students about hot mixture.

4. Send home a letter to parents written by students telling about their experiences.

5. Use some follow-up experiences in the popcorn learning center.

IV-D Social Studies Citizen Skills

Outdoor School (Gilfillan and Burgess, 1978, p. 14)

1. Learn some local history around the Outdoor School site to which students will be going. Determine possible sources, speakers, local Chamber of Commerce. Display and share findings.

2. Discuss the need for cooperation in the sharing of materials, equipment, and ideas when preparing items of class equipment for Outdoor School. Discuss the idea of the rights of other students who will be attending the Outdoor School. Discuss solving problems cooperatively. Discuss the experiencing of success and failure.

3. Roleplay social situations that students may need to be aware of. Learn how to introduce a guest at mealtime and how to direct and carry on a conversation. Ask two students to demonstrate first. Let students pair up and act out experiences. Discuss how one accepts criticism and suggestions with the proper attitude.

The Weewish Tree (Henry, 1980, p. 9)

One of the most popular Cherokee foods is bread. Most breads are made from corn flour. The corn is left on the stalk until it dries, then it is harvested. The dried kernels are then removed and ground into a powder or flour.

Let's look at the different types of Cherokee breads:

1. Bean Bread: To make this food the corn flour is mixed with boiled dry beans (leather breeches) and then the whole thing is dropped into boiling water. It is usually eaten cold as a bread. Hot bean bread is often used as dumplings and added to stews and soups.

2. Chestnut Bread: This is made similar to bean bread except that chestnuts are used instead of boiled leather breeches.

3. Sweet Potato Bread: This is also made similar to bean bread. Here sweet potatoes are used instead of beans.

4. Carrot Bread: Another version of the basic bean bread is carrot bread. Raw carrots are placed into the corn flour and boiled into individual sized, often lumpy, loaves. All four of these breads are best made in small

loaves because they crumble easily. They look more like big rolls than loaves of bread.

Note: With all activities, let children work in small groups. Supervise any use of equipment.

National Hispanic Week (Newmann, 1980, pp. 17-18)

It isn't possible, in five school days, to deal in depth with America's Hispanic heritage. But this week can afford the beginning of a year-long awareness of the many heritages of America's people.

A classroom chart, compiled by the students and based on the one below, can be started this week. Additions to the chart can be made throughout the year. These could emphasize the ethnic origins of class members or of groups of people who interest the individual children and have contributed to making our country "The Great Melting Pot".

The children make the illustrations for this chart, and it can remain posted all year.

Here are some ways in which the people of America have influenced each other.

A. Foods we get from: (taste each)

1. Native Americans

   corn, squash, beans, chile, turkey

2. Spaniards

   fruit trees, spices, sugar, grains

3. Mexicans

   chocolate, tomatoes, peas, potatoes

B. Clothing we get from: (display each)

1. Native Americans

turquoise and shell bead necklaces, moccasins, leather fringe

2. Spaniards

laces, full skirts, cowboy-style clothing

3. Mexicans

woven serapes, rebozos, juipils

C. Tools we get from: (see in a museum)

1. Native Americans

pottery, baskets, hanging loom, irrigation canal system

2. Spaniards

guns, the wheel, work horses

3. Mexicans

wooden ranching and farming tools

D. Architecture: (take a tour to see)

1. Native Americans

adobe building bricks, vaulted horno ovens, apartment multi-dwelling buildings

2. Spaniards

arches, iron grill work on windows and doors, patios, tiles, carved support posts, chimney construction

3. Mexicans

viga roof beams, latilla cross lattice-work of ceilings.

E. Words we get from:

1. Native Americans

moccasins, skunk, wigwam, squaw, toboggan, racoon, tomahawk, totem, bayou, caribou, chipmunk, hickory, hominy, moose, opposum

2. Spaniards

patio, canyon, bronco, sombrero, taco, mosquito, pronto, key, vigilante, tornado, sierra, cockroach, burro, buffalo, breeze, alligator

F. Life values we get from:

1. Native Americans

idea of an interdependence between all living things, art

2. Spaniards

Catholicism, communal ownership, water rights, Spanish music, art, dance

3. Mexicans

Mexican art, dance, music

Students could also trace on a world map the routes of the Spanish people to the New World, by way of Florida, New Mexico, California, and Arizona.

A Cave, A Dam, A River (Phillips, 1978, pp. 703-704)

Study of the environment can become an involvement in current political issues. These students explored a cave, watched water drip to form stalagmites and stalactites. They turned off their lamps to experience the dark. They

developed questions.

When the class visited the local dam, they collected newspaper articles about it, got a Conservation Department booklet of facts, did research, and listened to local speakers express their opinions. Then the students organized a class debate with pros and cons. The students also learned how to interview citizens to get their opinions. So they learned about samples of public opinion for polls.

The adventure then became material for expressing, for talking and writing about our cave, our dam, our river. In the process we learned much about people, ourselves and our community.

Shaping Up the Class Trip (Zeitz, 1979, pp. 72,74,76-77)

Students practice map-making by constructing a map of the school. If students are old enough they may make measurements between points, such as between the nurse's and principal's office.

Then students help plan a trip. Begin with a local walk. Each student develops a trip board, an organizational device. It contains a layout of the route, a list of pertinent questions, space for drawing, station stops (for rapid transit systems) or landmarks, and perhaps a list of workers for the children to watch and count. Pages are attached to a backing of sturdy cardboard. These give the children a sense of purpose, foci for observation, and build steps toward "independence" in a complicated urban

community. Thus, rather than being whisked about with no idea where they are, the children will know when they are coming to and arriving at their destination.

Back in class, the boards provide a reminder of the events and sights of the trip. The children can more easily understand, discuss and write about their experience. Any trip is more meaningful when the children understand where they are and how they got there. The trip board is a multipurpose tool that can be tailored to any need, community and age of children.

Simulation Game (Zenger, 1977, pp. 126-127)

How it works: First, set up the room in a particular way if necessary. Assign designated roles to students and talk about procedures and rules of the game. Then, the students actually play the game by acting out their parts and making decisions. The entire class can take part in the game wither as individuals or as small groups. After the game, students should discuss the situations, events, and results of the game.

Example and Information: U.S. History, grades 5-6: Give students the same advice that General Grant and General Lee were given during the Civil War before a particular battle. They are to change their tactics as each side also changes. This causes the learners to be more aware of the many problems of battle, and probably will motivate them to do outside reading about what really happened.

Advantages

1. Causes students to become very motivated.
2. Helps learners become involved in real life situations.
3. Is especially good for slow learners.
4. Requires each learner to become actively involved.
5. Can aid students in learning how to think critically and objectively.
6. Is a change in the classroom routine.
7. Helps develop communication skills.
8. Makes for easier comprehension, judgment, socialization.

Disadvantages

1. Can be expensive and very time-consuming.
2. Exaggerates reality sometimes.
3. May be only fun with no planned objectives in mind.
4. Can be difficult to evaluate individuals.
5. Might be hard to play because of discipline problems or number of students in the class.
6. May cause the pupil to think he knows everything about the subject.

Section 2. Pilot Unit for an Experiential Classroom

As a result of this research, the author developed a series of activities based on the philosophy of experiential education. These activities were to expand a school science textbook unit (Heath, 1980, pp. 111-139) on the nature of matter. The unit and activities were presented to 40 fourth-grade students. Included here is a description of procedure, activities and outcomes.

The book unit was 28 pages long and had eight experiments which required mostly kitchen equipment. The unit began with a text explanation of the interchangeable nature of solids, liquids and gases due to atomic structure. The use of heat as energy input for state change was discussed briefly and demonstrated by text-experiments. The text explained that in solids, atoms are closely packed in order, in liquids they spread out more and more, and in gases they move rapidly and expand. A set of worksheet activities acoompanied the text.

To help students gain an understanding at an experiential level of atoms and molecules, the writer initiated a series of activities:

1. The teacher drew an atomic structure on the board and asked the students what it might be. After brainstorming, the teacher explained the theory. Debbie demonstrated it with her stuffed bear on a leash. She whirled the bear around her head. The children hypothesized about what would happen if she made the object (bear) go faster or slower, i.e., more

or less energy. Each student was then given a string and a small beanbag. These were tied together. The class went outside to an open space so each student could pretend to be atoms with moving electrons. They found that there was a limit to how close they could get to one another without tangling string-and-bag 'electrons'.

2. In the classroom, the writer asked the children to pretend again that they were each an atom. How could they be a solid? They massed together, some protesting, while loudly discussing that they had to stand still and be quiet. When they were ready, the teacher asked them if there was still some space between them. They affirmed there was. The teacher mentioned that this was just like tiny atoms in any solid. Next the writer asked what would happen if their solid became liquid. The students spread out, even before they constructed verbal responses. Some were enthusiastically demonstrating atomic oscillation without knowing the term, based on a statement in the text, that atoms vibrate back and forth. The teacher pointed these students out to the class. The next question, with verbal safety warnings and precautions, asked what happens when the liquid becomes a gas. The children moved quickly around the room, with less jossling than previously observed, some responding with exaggerated physical leaps. Again, these actions were pointed out, parallels to (theoretical) atomic behavior were drawn.

3. A candle in a can was lit and held under a saucepan containing an ice cube. The children took turns holding the

pan. A few students also tried experiments with the candle flame-- touching, creating air movement to cause the flame to flicker, and putting it out. They commented on the black spots on the bottom of the pan. These led to further discussions and soot-drawings.

When the ice had melted, the time was recorded and the water measured. The children voluntarily wanted to continue the experiment through the evaporation stage. So the class continued. Simultaneously, the change of the candle from solid to liquid to gas, leaving a carbon residue, was discussed.

4. Using hard candies, students observed how solids can dissolve in(to) liquids. The students discussed how their bodies use food and the form it takes, reviewing a previous science unit. They discussed which parts of human anatomy are solid, liquid and gas. Using food-coloring tablets, students watched how the mixing of atoms is slowed by ice-cold water and speeded by heating, using three containers simultaneously.

5. Using small bar magnets, the children experimented with attraction/repulsion aspects of magnetism. With one large round magnet (8cm. diameter) and one small round magnet (9mm. diameter) together, they observed dramatic relationships between forces, motion and size. The children chose partners; each was a magnet. Fronts were north, backs were south. They worked out and demonstrated the concept that opposites attract and like poles repel.

6. One student brought a solar kit consisting of a solar chip, wires, transformer, and various labeled circuit parts which conducted electricity through a switch to a radio, light bulb or bell. The class took the kit to the playground where the students watched, questioned and offered advice while their peer assembled the circuit and made the light flash and the bell sound. The students became aware of their positions in casting shadows across the solar cell which reduced its activity dramatically. The radio did not successfully respond, which was hypothesized to be due to faulty wiring or insufficient sunlight. Another student demonstrated solar heat energy with a concave mirror and test-tube of water. The water boiled away.

7. In order to look at various forms of energy, the students did a variety of projects:

a. They made windmills of several types to demonstrate atoms in motion (wind).

b. They watched a nightlight bulb to see emitted light from the heated filament.

c. They constructed a colonial moving toy, a woodchopper, to look at mechanical motion.

d. They took apart a simple fan motor to look at coils and circuits, and made drawings of the path of the electricity.

e. They mixed vinegar and baking soda and put

the mixture in plastic bottle-rockets to observe chemical energy. They mixed vinegar and milk to observe chemical reaction causing separation of liquid and solid.

f. They did soap-bubble experiments with liquid dish-soap and straws, dishes and needles. The students blew bubbles in the dishes of soap and water mixtures. The mounds of bubbles soon spread over the desks. Students discovered they could blow huge bubbles, bubbles inside bubbles, joining bubbles, as well as floating ones. They explored surface tension. Then they floated needles on water surfaces, but found the needles sank when soap was added.

g. They compared verbally the action of atoms on water surface with magnetic action. These experiments showed students aspects of the interchange between matter and energy.

The effect of students dramatizing scientific yet often unseeable concepts was an increase in understanding as measured by increased verbal clarity, retention, written recall, and generalization of atomic concepts.

The science unit on matter (Heath, 1980, pp. 111-139) was covered in one hour per day, four days a week for two weeks, February 16 to 25, 1982. Pre- and post-tests given were the text-accompanying examinations. The pre-test was

given after the first day unit introduction. The post-tests, one text and one teacher constructed, were given on the last day after students completed readings, experiments, activities and discussions. The Appendix gives the percentile scores of student pre- and post-tests.

Day Number	Inaccurate	Accurate
1	29	14
2	24	12
3	21	19
4	14	18
5	14	36
6	22	23
7	21	26
8	8	24

FIGURE 3. COMPARISON OF ACCURACY OF STUDENT STATEMENTS

Outcomes

Students' statements during whole-class discussion were recorded as being accurate or inaccurate based on teacher judgment. These were recorded daily and then counted to give a daily class tally comparing accurate to inaccurate statements. The students' first discussion showed twice as many inaccurate statements as accurate. The final discussion showed three times as many accurate statements as inaccurate.

PRE-TEST

Percent range of scores: 8 to 84

Mean Score: 52.03%

POST-TEST

Percent range of scores: 56 to 98

Mean Score: 79.05%

WRITTEN GENERALIZATION TEST

Percent range of scores: 32 to 96

Mean Score: 76.15%

FIGURE 4. PILOT STUDY STUDENT SCORES

Outcomes

The text-accompanying pre-test was administered after the indicated introduction. There was a wide spread of scores and most scores were not at a passing level. The post-test showed a smaller spread of scores, with most scores being in the passing range, averaging 79%. The generalization test was teacher-developed from the list of concepts at the end of the chapter. Students were asked to give daily life examples of each concept. The average score was within the passing range.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Experiential education is an important, often controversial concept in education. For professionals in the field who are interested in student activities, sources and research are widely scattered. This paper is to synthesize recent work in this area.

Many authors contribute to the philosophy of experiential education, but researchers are still unable to determine significant differences between experiential and traditional educational methods. This research organized published examples of activities according to academic subjects and Knowles' taxonomy of skills. The author also developed and implemented a science unit of activities for fourth-grade students.

The conclusions drawn from this research are 1) research has not yet determined greater effectiveness of either traditional or experiential methods, 2) subject areas vary in their generation of experiential activities, and 3) experiential activities improve student motivation.

Recommendations for use include 1) using learners' five senses as learning tools, 2) using experience to aid students to acquire new content, and 3) using the community as a resource.

Suggestions for further research are 1) defining the effects of variables on learners and 2) determining long-range effectiveness of various methods.

Conclusions

There are three major conclusions from this research. The first is that the psychological research comparing traditional classroom methods with experiential methods is inconclusive. Some research finds significant positive effects with experiential programs. Most researchers report no (statistical) significance at the .05 level in the study results. This may be due in part to the great number of variables often unaccounted for in working with groups of people and the individualistic responses to experience which are difficult to explain and control.

The second conclusion is that the subject matter areas vary in their amount of experiential material generated. Science shows the most experiential literature, followed by math and social studies. Math has many experiences that affect computing skills, fewer in problem-solving skills and less literature that focuses on self and citizenship development. Language arts show the fewest experiential materials, some of which are labeled experiential but which have no student personal involvement.

The third conclusion is that experience tends to generate interest and enthusiasm in students, parents, and teachers, based on reported results. Active involvement expands levels of participation.

Recommendations for Classroom Use

Many of the activities group here are ready for immediate classroom application. Some require more preparation and materials. Each individual who reads an activity may find variations and modifications suggested by a particular circumstance, situation, and group of learners. Drawing on Bruner (1960), any material may be presented to any age student by relating or modifying the presentation to the student.

The basis of experience is the five senses. Using these as tools of observation, students can learn to verbalize data, then draw from it implications, judgments, conclusions, alternatives and meanings. Putting experience into words is often difficult, yet may expand and clarify the usefulness of the experience.

Teaching with what appear to be limited resources, teachers draw on students' past experiences and inner abilities. Discussion may stimulate and link memories. These past experiences can then be used to build comparisons and analogies. Through developing imaging techniques, the teacher can guide students through experiences not possible in regular classrooms. Yet imaging allows individual synthesis, use and development of experience in expanding cycles.

Creative use of community provides an endless variety of potential experiences, either during school time or later. Carefully planned inclusion of the community in the educational process has positive side effects, such as rapport,

improved communication, and integration of a school and its community. Trips need not be complicated to provide high classroom mileage. They can be simple, with appropriate preparation, focus and follow-up, and the results have long-range effects. For examples see Gilfillan and Burgess (1978), Grimshaw (1978), Zeitz (1979(, Anderson (1980), and Dawson (1982).

Suggestions for Further Research

The research that has been done in the past five years with experiential education appears to be of two types. One set of empirical studies is done mostly by educational psychologists, with a focus on a single learner or teacher variable. Examples of this research are Minor (1977), Braver (1978), Moulton (1978), VanRennes (1978), Drake (1979) and Schunk (1981). Another set takes a global approach that does not distinguish between variables, rather between larger major concepts of learning and teaching. Examples of this include Ellis (1977), Greenwood, et al. (1977), Wright (1977), Grimshaw (1978), McClure, et al. (1978), Kazdin (1979), Richter and Tjosvold (1980).

There is a need for further research in defining effects of variables on learner outcomes. With the current recognition of multiethnic classrooms and cultural differences, educators affect teaching methods, which Minor (1977), and Feldman and Acredolo (1979) also expressed as concerns.

There is almost no research to determine long-term effectiveness of various methods. Studies comparing these effects over time may demonstrate differences which are not easily measurable in short-term experiments and observations.

It is the challenge of education to develop purposeful learning, to help each learner's search, directed by his own motives and perceptions, his own desire to learn and grow. This puts the real focus on the learner rather than on the undifferentiated mass. This direction must shape educational policy and activity, not judging directions as right and wrong, but simply different (Overly, 1979). Educators need research to gain understanding into this process of relating perception and educational development. Such research takes curriculum development beyond personal and interest group viewpoints to a more universal basis of common experience.

Each generation sees academic education through its own perspective, affected by social and economic conditions. Each new group of graduates from the system create tradition by seeking to maintain the forms and purposes most familiar to them. But when each individual human can accept education as a personal continuous responsibility happening any time, any place, then formal education and research can provide us with a multilateral focus on means and processes flexible enough to meet changing needs in a changing world.

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APPENDIX: STUDENT SCORES

STUDENT NUMBER	PRETEST(%)	POST-TEST(%)	GENERALIZATION TEST(%)
1	61	78	66
2	63	58	40
3	80	98	90
4	23	66	70
5	68	70	88
6	70	82	96
7	84	88	92
8	42	86	78
9	72	82	86
10	65	76	80
11	60	96	72
12	62	64	82
13	36	68	88
14	62	94	70
15	12	72	76
16	21	70	68
17	64	76	86
18	48	68	62
19	60	78	32
20	40	94	96
21	32	62	64
22	55	76	84
23	30	56	82
24	72	96	84
25	18	74	66
26	14	64	74
27	8	62	74
28	64	84	82
29	14	66	62
30	80	92	86
31	62	84	76

APPENDIX -- continued

STUDENT NUMBER	PRETEST(%)	POST-TEST(%)	GENERALIZATION TEST(%)
32	60	90	88
33	72	86	86
34	74	94	82
35	40	82	74
36	70	88	80
37	82	92	82
38	61	82	78
39	62	98	70
40	18	70	54